METAL INDUSTRY
FABRICATION · ASSEMBLING · PLATING · FINISHING
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Editorial

Plating to Specification

Working to specifications is always a two-part job: first, knowing the specifications; second, meeting them. In many fields both parts of this job are fairly easy as the industries are well standardized. In electroplating, however, both parts are still troublesome.

For the first part, we still have very few specifications and those which we have are not yet widely enough accepted. Aside from the automobile and its allied trades, the consumers of electroplating work are learning very slowly. For the second part, the mere business of depositing a predetermined thickness or weight of metal is far from a simple procedure. It is not an automatic operation. We cannot "set the clock and forget it". Even though the length of plating time may be calculated from theoretical formulae, it is only approximate in practice. Deposits must be checked by pilot pieces in the tank and by measurement of samples at proper times. The article in this issue on "Plating to Specification" by Nathaniel Hall is a clear summary of present day methods.

We still have in this problem, a large nut to crack.

No Rest in Selling

In one field today we have a rate of activity that is almost feverish—the search for a "formula" or a "key" or a "lever" for selling more goods.

The oldest device for accomplishing this purpose is the cut price—the bargain. This method calls for no originality and, as often practiced, gives evidence of not much common sense either. Another plan which bears the mark of higher intelligence is to offer better quality; produced by better methods or at lower cost and consequently, not just another form of unintelligent price-cutting.

Times like these tax the ingenuity of the Sales Manager and he will often shift some of his troubles to the shoulders of the Designer and the Production Manager, demanding better looking products, better made. For example, he might go very much farther and fare much worse than to call for a new finish—a finish that lasts—a plate that is heavier and more durable as well as beautiful.

One stern fact stands out clearly today as never before. Every possible ounce of energy must go into sales effort. To relax in any way, from advertising to personal calls, on the ground that "it's no use now" is certain business suicide.

Platers' Convention

The 26th Annual Convention of the American Electro-Platers' Society has now joined the others in History. Held in the midst of a "recession", it broke no numerical records. In spirit and quality, however, it has never been surpassed. The attendance was good and the interest was keen.

The papers presented covered such subjects as bright nickel, bright zinc, Rochelle salt-copper baths, metal coloring, etc., the most important phases of metal finishing before the eyes of the industry at this time. The trend of the papers and the discussion showed clearly that electroplating is steadily continuing to change from an art to a metallurgical science. Specifications are becoming the order of the day.

All congratulations to the Milwaukee Branch.

Playing with Fire

The fire hazard in metal finishing is, on the whole, small, with the exception of one department—lacquering—in which finishes with inflammable bases are used. How important experience and care are in this department is the point of a story published in a recent issue of the Industrial Bulletin of the New York State Labor Department.

A boy seventeen years old was standing near a bench with a lighted blow torch in his hand. On the bench nearby, was a quart bottle of lacquer thinner. The boy was warned to keep his torch away from it but through some carelessness the bottle was knocked off the bench spilling its contents on the floor. The flame from the torch touched the thinner which immediately burst into flames, igniting the boy's clothing. He then made his last mistake, running around the shop, and before anyone could catch him and extinguish the flames from his burning clothing, his body was so severely burned that he lived but a few days longer.

Several lessons:

1. No open flames in the vicinity of lacquer or any other inflammables.

2. Special care in handling inflammables to avoid spilling.

3. In case clothing catches fire, NEVER RUN. The flames should be smothered or quenched with water as quickly as possible.

Electroplaters Convention a Great Success

26th Annual Meeting in Milwaukee makes important constitutional changes. Valuable papers and splendid exhibits of plated work.

MILWAUKEE was the hospitable host to the 26th Annual Convention of the American Electro-Platers' Society. Beginning early on Sunday morning, June 12th, delegates and visitors from all corners of the country streamed into the Hotel Schroeder, the headquarters of the convention. In an incredibly short time the officials were over their heads in work, but under the excellent preparations of the General Committee, headed by *R. M. Goodsell*, everything functioned smoothly and rapidly. A total of 532 members and guests registered; a fine record.

At the opening meeting on Monday at 9 A. M., the convention was welcomed to Milwaukee by *Mayor D. W. Hoan*, who threw open wide the gates to the city. *R. M. Goodsell* made an address and *A. B. Wilson*, President of the American Electro-Platers' Society, delivered the Presidential Address in which he reviewed the activities of the past year.

On Monday afternoon at 1:30 P. M. the first Educational Session was held with *George B. Hogaboom* of the Hanson-Van Winkle-Munning Company, Matawan, N. J., as chairman. (A report of this and succeeding educational sessions will be found later in this article.) On Monday night the International Fellowship Club held its annual Open House in the Silver Ball Room of the Hotel. This

W. M. PHILLIPS
President, A.E.S.

R. M. GOODSELL
1st Vice-President, A.E.S.

Club, which is composed of representatives of the companies which manufacture equipment and supplies for the electroplating industry, "did itself proud". The dance orchestra, the entertainment, the refreshments, were all of the highest order but the most important element in the evening was the good fellowship with which the Club is so richly endowed.

New Officers International Fellowship Club

The following men were elected to office in the International Fellowship Club for the year 1938-1939.

Chairman, *Oliver J. Sizelove*, Frederick Gumm Chemical Co., Kearney, N. J.

Vice-Chairman, *Jack Geissman*, Maas & Waldstein Co., Milwaukee, Wis.

Secretary-Treasurer, *Thomas A. Trumbour*, Metal Industry, N. Y. re-elected.

The ladies spent Monday afternoon making a tour of the points of interest of Milwaukee. In the evening they accompanied the men as guests of the International Fellowship Club Open House.

Tuesday was a busy day for everyone. The Educational Sessions started at 8:30 A. M. At 12:30 everyone boarded cars for Waukesha Beach to attend the picnic which was replete with abundant food, entertainment and sports. The East played the West at baseball but there seems to have been a "misunderstanding". According to reports from the Westerners the score varied from 9-7 to 19-6. The Easterners had little to say on the subject except to intimate unspeakable things about the fairness of the umpire. Our guess is that everybody won and nobody lost anything.

FREDERICK FULFORTH
2nd Vice-President, A.E.S.

JOSEPH L. DOWNES
3rd Vice-President

The ladies were entertained by the picnic on Tuesday afternoon and the card party at 8:30 P. M.

On Wednesday, June 15th, the ladies' entertainment started at 1:30 P. M. when they were conducted on a visit through the Phoenix Hosiery plant to see how silk stockings were made. In the evening they were treated to a theatre party while the men attended the evening educational session.

The men began the day with a choice of plant visitations dividing themselves between the National Plating Company, the S. K. Williams Company and the Cutler-Hammer Co. In the afternoon and evening they attended the educational sessions.

JACK GEISSMAN
Vice-Chairman, International Fellowship Club

Changes in the Constitution

Important changes were made in the Constitution of the American Electro-Platers' Society.

The first amendment was a change in the membership rules. From now on anyone engaged in the electroplating industry is eligible to membership if elected by a majority vote of the Branch applied for. This includes supply house men also, but polishers and buffers are ineligible to join as they are not engaged in plating.

A 45% increase in per capita tax was passed to defray the cost of sending a full set of proceedings of the Convention to every member. Since this makes it unnecessary to publish every paper read at the Convention in The Monthly Review, it leaves room

OLIVER J. SIZELOVE
Chairman, International Fellowship Club

in The Review for more current material.

Another amendment adopted referred to the convention finances. From now on the Branch holding the Convention will be permitted to retain the profit only up to $500; the surplus over that figure is to go to the National Society. This will remove the incentive for Branches to hold exhibits and raise large sums of money in other ways.

New Officers

The following officers were elected for the coming year 1938-1939.

President, *William M. Phillips*, Detroit Branch.

W. J. R. KENNEDY
Executive Secretary, A.E.S.

First Vice-President, *R. M. Goodsell*, Milwaukee Branch.

Second Vice-President, *Frederick Fulforth*, Philadelphia Branch.

Third Vice-President, *Joseph Downes*, New Haven Branch.

Executive Secretary, *W. J. R. Kennedy*, (re-elected).

New Honorary Members

Two new honorary members were added to the rolls of the Society, *Philip Sievering*, Newark Branch and *Walter S. Barrows*, Montreal Branch.

Coming Conventions Allotted

The 1939 convention was, as ar-

T. A. TRUMBOUR
Secretary-Treasurer, International Fellowship Club

ranged last year, allotted to the Newark Branch, to be held in Asbury Park, N. J. This, it is understood, will be an International Conference on electroplating. The General Chairman of the convention will be *Horace Smith*, "the leading showman of the Society." *George B. Hogaboom* will be Educational Chairman and *George Wagner*, Secretary. The 1940 convention will be held in Montreal, Canada or Dayton, Ohio. The 1941 convention may be held in Boston.

The annual banquet which was attended by over 600, was held on Thursday evening, June 16. Addresses were made by *Austin B. Wilson*, and *Dexter Rhodes*. *George B. Hogaboom* then formally introduced *W. M. Phillips* as the new president and he took the chair.

Prizes and Awards

Edward Heunerfauth of the Crown Rheostat & Supply Company, Chicago, Ill., announced that a trophy will be offered in memory of his father the late *Sam E. Heunerfauth*, for the best Branch papers, beginning at the 1939 convention.

The A. E. S. Gold Medal for 1938 was awarded to *W. L. Pinner* and *L. B. Sperry* for their paper "*Experiences in Evaluating Plated Coatings*".

The Founders' Gold Medal for 1938 was awarded to *Frank C. Mesle* for his paper entitled, "*A Resume of Silver Plating*".

The Herminie Dorothea Proctor prize for 1938 was awarded to *R. M. Wagner* for his paper "*Rochelle Salt-Cyanide Copper Baths.*"

F. C. MESLE
Winner, Founder's Gold Medal

Exhibits

The METAL INDUSTRY cup was carried off this year by the Dayton Branch for the best group exhibit shown. Individual exhibits were rated as follows:

First prize, *Leon Haas*, Dayton Branch.

Second prize, *Frank Savage*, Chicago Branch.

Third prize, *J. Brydon*, Chicago Branch.

The exhibition of plated work ranked with the best ever shown by the Society. A valuable innovation was the complete description attached to each exhibit giving details of the finish and of the methods used in applying it. A summary of the methods and formulae used for obtaining these coatings will be reported in coming issues of METAL INDUSTRY.

Here and There About the Town

The Annual "Kickers' Handicap" Golf Tournament was run for the Fellowship Club Silver Cup at the Tuckaway Country Club on Wednesday afternoon and Thursday morning. The trophy, donated by R. C. Rehberger Company, Chicago, was won by *Bill Wiarda.*

One of the welcome faces at the convention was that of *Walter Fraine* of the National Cash Register Company who was prevented by illness from attending the convention in New York last year. Mr. Fraine has retired from active service but his heart is still very much with the Society.

Another "new" face at the Convention was *H. H. Williams* of the St. Louis Branch, past president of the National Society. This was Mr. Williams' first convention in eight years and he was made heartily welcome.

The American Electro-Platers' Society Research Fund was the beneficiary of a raffle for a Winsome Chime Clock donated by the *New Haven Clock Co.*, New Haven, Conn. *Joan Trumbour Wiarda* of METAL INDUSTRY, New York, was in charge of this benefit and collected $104.50 for the good cause.

Wisconsin Master Platers Association Meets During A.E.S. Convention

The following representatives of plating firms were the guests of the Wisconsin Master Platers Association at a dinner held June 15, in Milwaukee during the Convention.

I. M. Herman, president of W. M. P. A., Milwaukee; *Philip Sievering*, New York; *Nelson Sievering*, New York; *S. K. Williams*, Milwaukee; *K. K. Williams*, Milwaukee, Sec. W. M. P. A.; *R. Steurnagel*, Milwaukee; *R. Steurnagel, Jr.*, Milwaukee; *H. Sandberg*, Chicago; *G. Westerberg*, Chicago; *J. Lockerbie*, Goshen, Ind; *R. Lockerbie*, Goshen, Ind; *J. Bykowski*, Milwaukee; *J. Gerity*, *Toledo*, Ohio; *R. J. Nagle*, Toledo, Ohio; *W. Shepard*, Racine, Wisc.; *J. Miszewski*, Milwaukee; *J. Maliszewski*, Milwaukee; *R. Goodsell*, Racine, Wisc.; *E. Garalski*, Milaukee Wisc.; *N. Servatins.*

Philip Sievering who took the initial steps in organizing the Master Electro-Platers' Institute of the United States was chosen as chairman of the dinner meeting. He gave a talk on the benefits which can be derived from mutual cooperation in solving the many perplexing problems connected with the industry. The meeting discussed specifications and methods of meeting them, with the end in view of increasing the buyer's confidence in the plating field.

Mr. Herman advised that he had been delegated by the American Hot Dip Galvanizers Association to extend to the American Electro-Platers' Society, their best wishes for a successful convention.

The meeting was adjourned after a rising vote of thanks to the Wisconsin Master Platers' Association.

PHILIP SIEVERING
Newly-elected Honorary Member

Papers Read at the Educational Sessions

Abstracted by

GEORGE B. HOGABOOM

Hanson-Van Winkle-Munning Co.

1. *Summary of Research on Electrodeposition at the National Bureau of Standards. Dr. William Blum, Bureau of Standards.*

A general description was given of the work carried on at the Bureau of Standards during the past several years, but more especially of the past year. This work included the preparation of samples on non-ferrous metals for exposure tests; to be a confirmation of the specimens previously exposed. The work is about completed and the test panels will be placed upon the racks of the American Society of Testing Materials at their several stations. A description of the work of Brenner on the magnetic testing of the thickness of electroplated coatings on both magnetic and non-magnetic base metals. The determination of the thickness of the electroplated deposits on articles purchased under government specifications, especially plumbing fixtures, has resulted in a marked improvement in the quality of the work produced. At one time the percentage of rejection was very high, but now it is low, which proves that it is possible to meet definite specifications if reasonable care is used in processing. The extension of the work in the manufacture of printing plates at the Bureau of Engraving and Printing by the electrodeposition of iron was more fully described.

2. *Preparation of Specimens for Exposure Tests. P. W. C. Strausser, Research Associate of the A.E.S., Bureau of Standards.*

In the preparation of the panels of ferrous and non-ferrous metals for the exposure tests it was deemed advisable to have the plating done in commercial plants as well as at the Bureau of Standards. Practically all of the panels of non-ferrous metals were prepared in commercial plants where the regular method for preparation and plating was followed. The panels for bright nickel coatings were processed at the Bureau of Standards under the supervision of a representative of the firm which controls each process. These panels are to be exposed as bright nickel coatings and will lose their identities as individual processes. A detailed report was made of the manner in which all panels were processed and the probable time of placing them on the test racks. It is expected that this work will be started the week after the Convention. All those interested were invited to attend the inspection of these panels at the stated periods which will later be published. An expression of thanks was made to all manufacturers and the platers who assisted in this work.

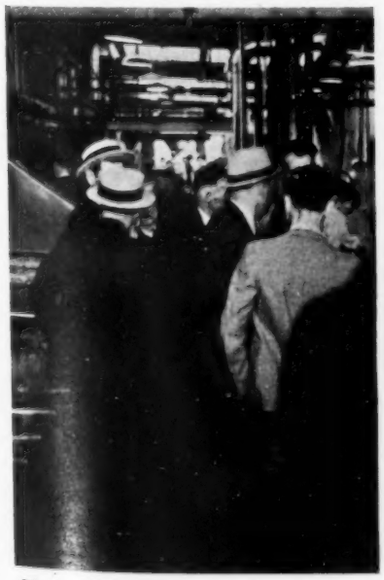
3. *Primary Current Distribution in Electrodeposition in Linear, Cylindrical and Spherical Conductors. C. Kasper, Bureau of Standards.*

It has been found that the direction of the line of crystal boundaries of electrodeposited metals runs at right angles to the surface upon which the metal is plated. This is in accordance with known mathematical calculations and is not offered as any new theory. It is hoped that in this paper and those that are to follow, this theory will be enlarged upon and explained in such a manner that it will be of a considerable help in the study of the distribution of electrodeposited coatings and of the throwing power of plating solutions.

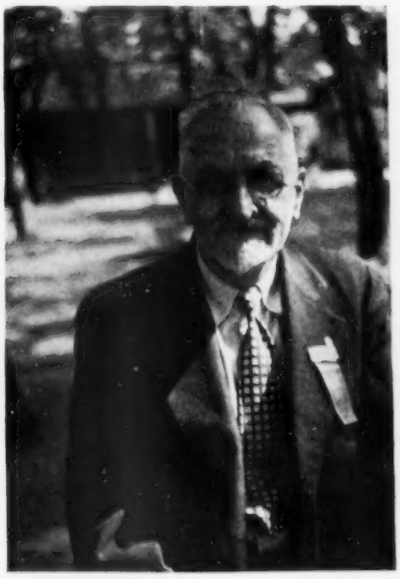
4. *Survey of Metal Cleaning. Dayton Branch. Charles C. Conley, National Cash Register Co.*

With the assistance of ten different firms a study was made of the present cleaning method and the solutions used for preparing all classes of fabricated metals manufactured in the Dayton district for plating. It was found that there is no definite man-

Metal Industry Photos



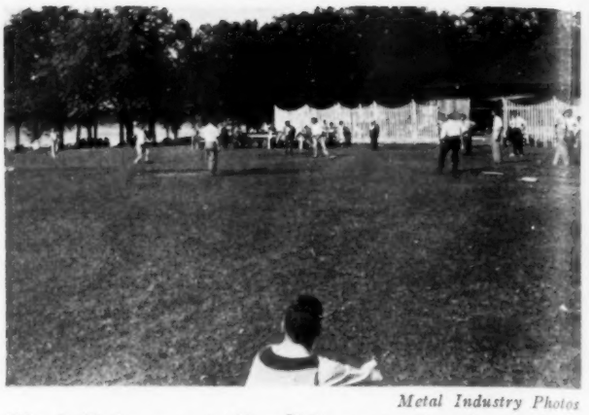
Plater visiting the Cutler Hammer plating department.



T. C. Eichstaedt, one of the Deans of the plating industry in the West.

Carl Heussner. He bosses all the metal finishes for the Chrysler Co.

Joe Downes looking around at the Outing. Joe is a newly elected Vice-President of the A.E.S. and we all think it was an excellent idea.



Metal Industry Photos

The ball (or was it "bawl"?) game. Puzzle—find the Umpire. Ed Christ just dashed off the picture to make a circus catch in left field.

ner in which the work is processed, in the composition of the cleaning solution or in the maintenance of the strength of the cleaner. There is a definite need for a systematic study of the methods used and of the composition of cleaning solutions. The control of plating solutions is general but the same principles have not been applied to cleaning solutions. A study was made of the effect of the component parts of a cleaner to ascertain as nearly as possible what would be considered a standard cleaner. The effect of this cleaner as a "soaking" solution and as an electric cleaner was determined by making solutions for still tanks and automatic machines. These solutions were controlled by chemical analysis at stated periods and a record was kept of the amount of each ingredient to restore the cleaner to its original composition. These additions were expressed in percentage which indicated that the rate of consumption of the ingredients of the cleaner is not uniform. Some of the chemicals were consumed rapidly while others did not seem to be affected even by drag-out.

5. *Advancements in Electroplating in a Lifetime. Boston Branch. Bert Sage, A. S. Campbell Co.*

The history of electroplating was described in a chronological fashion, in relating the lifetime history of a plater. The story started when wet batteries were used and continued through the conception of nickel plating by the use of double nickel salts to the present methods of high speed plating in solutions which are high in metal content. Several amusing incidents of the failures and successes were told in an interesting way. The whole panorama of the development of the electroplating industry was quite accurately described.

6. *Practical Demonstration of What Happens in a Plating Barrel. Dr. Burton G. Daw, Lasalco, Inc.*

The story of barrel plating has never been told in such an interesting manner. To illustrate the important features of plating work in a barrel unit some very unique demonstrations were made. In a Mason fruit jar of one quart capacity, definite quantities of screws were placed. In one jar was contained large screws of certain areas which completely filled the jar; in another, small screws of the same area filled the jar less than one third. This was used to indicate that it was not possible to calculate the amount of current or rather the current density

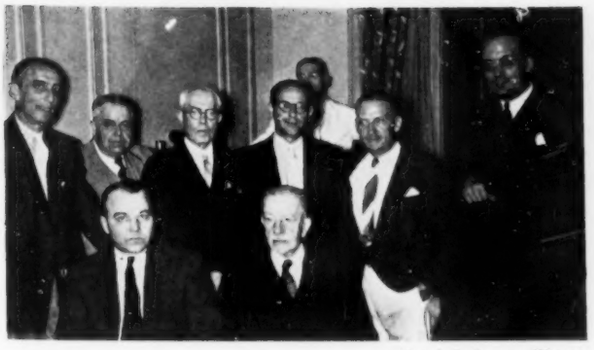
W. S. Barrows, newly elected Honorary Member. He has missed only 1 convention out of the 26.

Walter (Doctor to you) Meyer researching for a safe place to dive or not to dive as the case may be.

Metal Industry Photos

"Red" Wilson, Joe Downes and Carl Heussner talking it over. Is it politics or specifications?

Doc Young handing a "pitcher" to Harold Faint, the Umpire (and not ashamed of it, either.)



Metal Industry Photos

"Hail, Hail, the Gang's All Here!" Egyptian Lacquer —and what a gang!

that should be applied to a barrel of work if this is based upon the load in the barrel, without first knowing the area. A very unique set-up was made of a cross section of a hexagonal plating barrel. This was about a foot wide and fastened to an apparatus by which it could be revolved at several speeds. On one side of this section was a glass cover which permitted the observance of the rotation of the work. Loads of different classes of work and several amounts of each class of work were run. This was the first time such a picture of the internal operations of a printing barrel has been described.

7. *Physical Properties and Uses of Heavy Nickel Deposits. Dr. W. A. Wesley, International Nickel Co.*

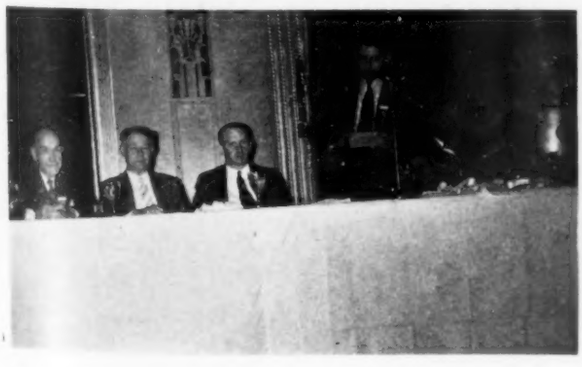
Most of the papers presented on nickel plating deal with ornamental coatings. There is a broader field opening, and that is of the building up undersized or worn parts by heavy electroplated nickel. This building up can be called metallurgically, casting by electrodeposition. This has distinct advantages over ordinary methods of casting as it avoids the detrimental effects that may be caused by heating. There is not enough known about the physical properties of electrodeposited metals. Hothersall has presented a chart of the hardness of several metals. He stated that nickel deposits could be made "soft" or "hard" according to the wish of the operator. This depended upon the composition of the solution and the current density employed. Several photomicrographs which illustrated the physical properties of nickel were shown. It is indicated that electrodeposited nickel can be made harder than that of rolled nickel. This was followed by several illustrations of the application of nickel for surfacing and the building up of different parts of equipment, either for salvaging or for protection against chemical corrosion, as in the case of making chemicals.

8. *Bright Nickel. G. Soderberg, Udylite Co.*

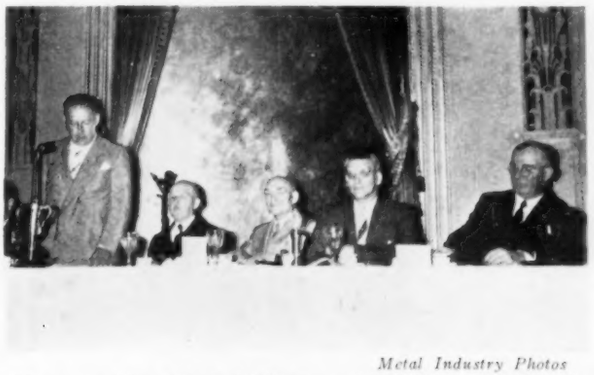
The advantages of bright nickel deposits were described, the most important being the elimination of buffing. The specifications for nickel deposits must include, good adhesion, freedom from porosity, absent of roughness, hardness, freedom from organic or inorganic occlusions and the ability to withstand a one hundred hour salt spray test for deposits of 0.001" thick. It is not believed possible to deposit bright nickel over a dull surface that will be acceptable for plating directly with chromium. The deposit however, must flow easily under the buff and be in a condition to take a chromium coating without any special treatment. The essential properties of the solution should be: stability, high efficiency, not sensitive to impurities, have a wide range for brightness from a low to a high current density, good throwing power, no sludge, which means that the addition agent must not be electrochemically decomposed. The bright nickel process should save labor, buffing composition and permit operation in a less expensive plant layout.

9. *Importance of Correct Anode Corrosion in Nickel Plating. W. Pinner and E. Borchardt, General Spring and Bumper Co.*

In the paper presented last year the discussion concerned the preparation of the work by cleaning, the composition of the bath, anode corrosion and general plating conditions. In this paper the character of the corrosion of cast nickel anodes was discussed and illustrated with several slides. The object of all nickel platers

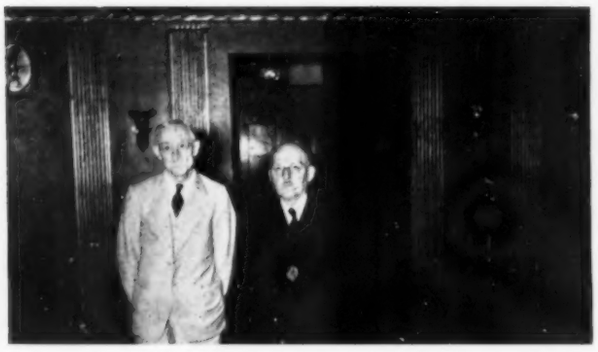


Toastmaster Rhodes keeping the ball a-rolling. Also visible are old-timers Barrows and Sievering and President Wilson—all very well fed.



Metal Industry Photos

The new President (Bill to us) Phillips telling the world. Alongside, in respectful silence are Messrs. Hogaboom, Goodsell, Fulforth and Downes.



A welcome face—Walter Fraine among those present after a long illness; accompanied by George Hogaboom who needs no introduction.

Metal Industry Photos

Tom Slattery and Frank Hanlon, past presidents. They're both having an equally good time but a stranger would never know it!

is to obtain smooth deposits that are free from all roughness. If any rough spots exist they are either chipped off or torn loose from spots which are magnified by subsequent chromium plating. It is recommended that anodes be bagged. This is an admission of poor anode corrosion. In low pH solutions the life of a bag is short. Carbon content anodes were developed so that the anode would have a bag of its own. The methods of making anodes is in the hands of the manufacturers as the plater is concerned only after the anode is in the solution. Several photographs were shown of anodes having sand and slag inclusions blow holes, pipes, non-uniform crystal structure and places where non-metallics were released. The carbon type anode that will give the best result should not have more than 0.0005 per cent carbon. Rough deposits are caused when the carbon particles are 0.04 per cent. The anodes that are now used contain between 0.001-0.005 per cent. It is admitted that good anode corrosion depends upon the condition of the solution. A poor plating bath will not corrode an anode properly. A chart giving the effect of different amounts of nickel chloride in a plating solution was given to indicate the effect of the chloride upon a cast anode. The plea was made for a better nickel anode.

10. *Investigations in Bright Zinc. New York Branch. Dr. C. B. F. Young.*

Zinc held the stage until the development of cadmium plating. It is now difficult to obtain cadmium and therefore attention is focused upon zinc. One of the main differences between zinc and cadmium deposits is that the former fingermark more easily. The experiments were made with different addition agents. Twelve men of the New York Branch worked under definite directions to obtain the desired data. One man obtained the best results by agitation which led to a more complete investigation of the effect of addition agents that were stable. No attempt was made to adapt the bath to the addition agent but rather to take a standard composition of solution and study the effect. The agents used were turkey red oil, bran and gum arabic. Other addition agents were studied but none gave any marked improvement. The bath used contained:

Zinc oxide	6.4 oz./gal.
Sodium cyanide	9.9 oz./gal.
Sodium hydroxide	10.0 oz./gal.
Current density	20-25 amps./sq. ft.

No definite recommendations were made as the result of this research.

11. *Answers to* 101 *Questions on Copper Plating. Springfield Branch. A. Hartshorne.*

The conditions met in operating a cyanide copper and a cyanide copper-Rochelle salt solution were discussed. These included the deposition of copper on several kinds of metal. Anode corrosion, cathode efficiency, current density, voltage, temperature, brightness, polarization and effect of carbonates were investigated. Considerable data were offered as to the kind of tanks to use, the distance between anode and cathode and the blistering of deposits. The removal of carbonates by the two methods offered was investigated and it was found that the better way was by "freezing out." A detailed description was given of the methods of analysis for the component parts of both solutions.

John Feeley and Joe Underwood, both looking at something—or someone—very engrossing, and liking it.

Metal Industry Photos

Jack Geissman—in good company—and ready to go right on with it.

The buffing department at the Cutler Hammer plant. Platers "looking them over" to find out "how" and "why." These visits are a valuable feature of the Platers Conventions.

Metal Industry Photos

Tom Trumbour—the Platers' Friend—and the only member who never missed a Convention. He's finding out how Horace Smith and Nelson Sievering are going to run the next convention. "Newark knows how!"

12. *The Effects of Metallic Impurities on the Structure of Cyanide Copper Deposits. Dr. Walter R. Meyer, General Electric Co.*

This was a very exhaustive study and was illustrated by a large number of remarkable photomicrographs. The effect of addition agents on the ductility of the deposit and the protection against corrosion was determined. There is practically nothing published on the subject of the effect of small quantities of different metals on the character of electrodeposits. This is important as the unfavorable effect should be known. Cadmium has long been used in nickel solutions; lead in copper solutions; vanadium, molybdenum, nickel and cobalt in zinc solutions. Lead and tin act as addition agents upon each other in a fluoride solutions. Rough deposits are as a rule caused by the precipitation of an added metal at the cathode which is included in the deposit. In a nickel solution zinc is precipitated at pH 5.2, copper pH 5.3 and nickel pH 6.7. Several slides were shown illustrating the effect of lead, thallium, cadmium, silver, tin, nickel and cobalt on a copper deposit from an acid solution. It was found that cobalt was not included in the deposit.

13. *A New Alloy From Cyanide Solutions. Floyd Oplinger, E. I. du Pont de Nemours & Co.*

An alloy high in zinc and low in copper has been successfully electroplated. It has been given the name of "White Brass." Solution used:

Zinc cyanide	8.0 oz./gal.
Copper cyanide	2.25 oz./gal.
Sodium cyanide	8.0 oz./gal.
Sodium hydroxide	8.0 oz./gal.
Sodium sulphide	0.05 oz./gal.
Anodes	Copper 28%; Zinc 72%
Current density	
	10 amps./sq. ft. at 25°C.
	15 amps./sq. ft. at 80°C.
Anode efficiency	80-100%
Copper content of deposit	30%, maximum

The deposit can be easily buffed. There was no evidence of porosity or pitting. This alloy is hard and quite brittle. It is not possible to deposit this alloy in a barrel. The anodes must be of the bar type cast upon a steel spine. Contrary to expectations this deposit is not rustproof. Several samples were exhibited.

14. *Cyanide Copper Bath—Rochelle Salt. Robert M. Wagner, Guide Lamp Div., General Motors Corp.*

All the conditions affecting the cyanide copper-Rochelle salt solution were first investigated in the laboratory and then in commercial production. A comprehensive study of all the factors affecting anode and cathode efficiency and the character of the copper deposit was made and a large number of data sheets were shown on the screen. This was by far the most intensive study that has been made of this interesting solution on a commercial production basis. All the methods of analyses of the chemicals entering into the composition of the solution were investigated. It was found that a solution operating under good conditions at elevated temperatures had a free cyanide effect greater than the analysis indicated. Considerable data were presented upon slides which will form an excellent basis for future investigations. It should be noted that it is not possible to chromium plate directly over the alloy deposit.

Irving Sohn begging A. B. Wilson and Fulforth for a seat. And will they give him one? No—the wretches; they say "We're too tired and you're too fat!"

Metal Industry Photos

Frank MacStoker and Bill Kennedy both looking very pleased about something—and we're sure its quite all right.

ture had a material effect upon the character of the deposit. Anode efficiency, cathode efficiency, polarization of both electrodes and their relation to the character of deposit was determined. It was found that iron decreased the anode efficiency when 0.5 gm./l. was had; a dark brown filmed formed on the anode. To determine whether a chromium plated rack could be used, the effect of small amounts of chromium was investigated. There was a rapid decrease of cathode efficiency; as little as 0.1 gm./l. stopped the deposition of copper. The presence of sodium sulphate, created when calcium sulphate was added to remove carbonates, decreased both the anode and cathode efficiency. It was found that bright nickel deposits could be made directly over an unbuffed copper deposit from this solution. The solution that gave satisfactory results is:

Copper cyanide	4.0 oz./gal.
Free cyanide	0.5 oz./gal.
Sodium carbonate	3.0 oz./gal.
Rochelle salts	5.0 oz./gal.
Temperature	140°F.
Current density	30 amps./sq. ft.

This solution gives best results when mechanically agitated.

15. *Dips and Their Uses in the Plating Cycle. Hartford Branch. Read by George B. Hogaboom.*

An outline is given of the preparation procedure for brass, copper, zinc, nickel silver and steel for plating in the different solutions used for decorative coatings. The effect of each of the several stages of operation was discussed in detail.

16. *Metal Coloring. George B. Hogaboom, Hanson-Van Winkle-Munning Co.*

A history of the Coloring of Metals was discussed. It has been found that the early alchemists lived in the centuries B.C. in Egypt and were colorers of metals. In two manuscripts that have been found—Papyrus X and the Stockholm manuscript, several references are made to the coloring of metals. In Papyrus X there are 111 recipes for metal alloys and the coloring of metals. One of the recipes, the formula for obtaining black on silver, includes "sulphur water." This "oxidized" silver was dedicated to the Egyptian god Anubis. A translation of a formula for bronzing metals has been paralleled with a formula published in "Metal Coloring" by Hiorns and it is of interest to know that the procedure given is identical. A description was given of several methods now in use for obtaining different finishes as well as several colors on metals. To illustrate this paper a large number of specimens, almost 600, were made and mounted. Descriptions of the processes and formulas were given.

17. *Effect of Carbonate and Sulphate on Cyanide Plating Solutions. R. O. Hull, E. I. du Pont de Nemours & Co.*

A comparison was made of the effect upon the dragout from different plating solutions containing various amounts of sodium carbonate and sodium sulphate. It was found that sodium carbonate increased the viscosity of solutions and therefore the drag out was greater than in solutions containing sodium sulphate. The solutions investigated were cadmium, copper, copper-Rochelle salt, zinc and silver.

18. *Electroplating Solves Manufacturing Problems. Detroit Branch. J. H. Hoefer, A. T. Wagner Co.*

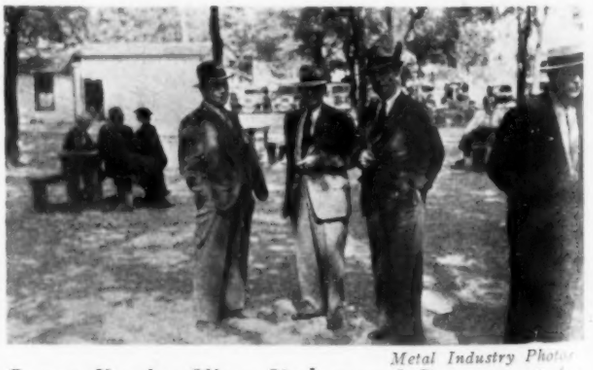
A detailed story was given of the many improvements that have been made in the electroplating of metals. This includes tin for decorative and for mechanical purposes. The copper plating of printing rolls by the Ballard Process, the brass plating of steel for rubber adhesion, copper plating for carburization, copper for the protection of mirrors, the electrolytic manufacture of caskets, the production of electrolytic copper sheets both continuous and perforated, copper radiator cores and the electroforming of printing plates with iron at the Bureau of Engraving and Printing.

It would be difficult to assemble a more complete story of the several applications of electrodeposition of metals.

19. *Wetting Agents in Plating Solutions. Newark Branch. L. R. Hunt.*

There is an increasing use of wetting agents in nickel plating solutions. There is a lack, however, of sufficient information as to the best conditions under which they operate. In this investigation it has been found essential to use high current density in a nickel solution in which an addition agent is used. Deposits obtained at low current densities are coarse and hard to buff. Wetting agents are generally primary and secondary alcohols. At present those advocated for use have not been found stable; nor is there any method for determining the quantity that can be used for the best results. The pH of the solution has an effect upon wetting agents. At pH 5.5 some of the wetting agents are precipitated and effect the character of the nickel deposit. It is suggested that methods of control with a potentiometer be developed for direct readings.

The Lea Boys—ball players and jollifiers: Crane, Couch, Mosher, Muscio and Bob Leather in person.



Metal Industry Photo

George Knecht, Oliver Sizelove and Downes out for "a little airing". Walking off the picture is Sam Cole.

20. *Industrial Finish Manufacture. E. Bucy, Zapon Brevolite Div., Atlas Powder Co.*

The use of organic finishes dates back to the beginning of civilization. Articles that were produced by resins or lacquers in the ancient times have been found in excellent state of preservation. Early in the twentieth century synthetic resins were developed which were added to nitrocellulose mixtures to improve the hardness and gloss of the coating. In 1920 the use of butyl compounds replaced those made by amyl alcohol. Alkyds produced by ethyl glycol give more gloss to the finish. Tung oil when treated has proved a valuable addition to lacquer. A new compound of formaldehyde has been found that dries in a different method than that of existing lacquer compounds. The change is in the molecular structure rather than in the oxidation of the compound. The quality of this finish is excellent.

21. *Use of Solvent Emulsions in Cleaning. Dr. R. J. Mitchell, Magnus Chemical Co.*

Emulsion degreasing has been described by the author but the value has not been fully appreciated in metal cleaning. This differs from organic or alkaline cleaning in that it combines the best properties of both. A solution is made with sufficient emulsifying agent to both deflocculate and emulsify grease and dirt. Dirt becomes self-emulsifying. This is an advantage in that it brings the emulsion to a point where it is removed by water. The effect of emulsions on surface tension was discussed in detail. The solvent can be used at room temperature as a dip or a spray. The names of all the compounds and their uses were explained. This solvent is more adapted to cleaning metals that tarnish easily and also those that are easily attacked by alkalies such as aluminum and its alloys.

22. *Fume Exhaust Design. Toronto Branch. H. A. Smith, Coulter Copper & Brass Co.*

Fumes originate in certain localities in the plating room which must be segregated. This requires a properly designed exhaust system so that the fumes will be carried to the outside of the building. Simple systems consisting of several units are far more satisfactory than complex systems. It is necessary to ascertain all leaks possible such as doors, broken windows, or anything of a similar nature that will permit air to enter a room which will upset the system. Fan ducts, air flow and draughts were fully described. Filtering of the air so as to keep a fresh quantity in the room in a clean state is essential.

23. *Practical Solution Maintenance. Philadelphia Branch. Frederick Fulforth, Proctor & Schwartz.*

Platers are not scientists. The average type will be lost in the maze of technicalities. Few can originate new formulas. The American Electro-Platers' Society should investigate problems more promptly. Research on bright nickel solutions should have started at least five years ago. Practical solution control should be developed to assist those not able to take a general course in chemitry. Platers should receive instructions in the actual working of the plating solutions. At present they are told the formulas but not the operating conditions. They should know tank loads, temperatures, current density and all other factors entering into the production of good work. The methods of analysis of solutions are given but no instructions as how to restore the solution to its original condition. There should be detailed instruction showing the best operating conditions. Detailed methods of analyses of a number of plating solutions were given. The data assembled and discussed were of considerable importance.

24. *Matte and Bright Dipping. Waterbury Branch. George Muscio, Lea Mfg. Co.*

This was a general discussion of bright dipping as followed by the members of the Waterbury Branch. Brass parts must first be cleaned free from all grease in the alkali solutions that are in general use. To obtain a good finish on work that is annealed it should be first pickled in a sulphuric acid solution. This can then be followed by either the sulphuric acid-bichromate dip which gives a semi-lustrous satin finish or the regular sulphuric acid-nitric acid bright dip. To obtain the best results three dips are recommended.

1. A pickle for oxide and scale.
2. Fire off or scaling dip.
3. Clearing or bright dip.

The function of sulphuric acid is to dissolve the oxide; of nitric acid to brighten the work. Soot is used to overcome the effect of hydrochloric acid if added in excess. The range of content of the constituents is wide. Reasons and corrections for poor dipping results were given. Formulas for all dips and pickles with instruction for operations were given for matte dips.

A weighty gathering, but they are not talking about weighty subjects. Phillips, Oberender, Kennedy, Hazucha and Trumbour.

Metal Industry Photos

Ha! Ha! Steen Thompson (past president) has just told a good one to Doc Young. At least it looks like a good one.

A Simple Method of Plating Nickel on Stainless Steel

The use of a "nickel strike" improves adhesion and eliminates special racking problems.

By DONALD WOOD

Reed and Barton Corporation, Taunton, Mass.

IN the course of a study of methods for plating on stainless steels, one, suggested by *George B. Hogaboom*, has been found not only efficient for the purpose intended, but of great promise in a more general way. In fact it is for use on surfaces other than stainless steel that its greatest value has been found.

The Strike Solution

The process is very simple. It involves, in outline, a cathodic treatment in a solution of nickel chloride and hydrochloric acid. This operates at room temperature, from a 6 volt line, drawing 50-75 amperes per square foot. To obtain the degree of adhesion required (for silver) on stainless steel cutlery a treatment of about two minutes is necessary, while equal adhesion is obtained on brass, copper, and nickel silver in about 30 seconds. A deposit of nickel results at a cathode efficiency near 15% to which subsequent deposits readily adhere.

The solution is made about 2 Normal in nickel and 1.5 Normal or higher in hydrochloric acid. A satisfactory formula for making the solution is:

Nickel chloride	32 oz./gal.
Hydrochloric acid 22 Be	16 fl. oz./gal.

The value for the nickel concentration is not at all critical, being placed so high largely to furnish conductivity; but throwing power and the degree of adhesion on stainless steel are affected by too great a decrease in the acid concentration. Such a decrease results automatically from the difference in anode and cathode efficiencies and from the fact that the anodes are chemically soluble in the solution. To compensate for the decreasing acid concentration it is at present necessary to withdraw a sufficient volume of the bath to allow the addition of the acid required. It is to be expected that insoluble anodes, used intermittently or partially, will be a more satisfactory solution of this problem where the withdrawn solution cannot be economically used. In practice, frequent determination of the nickel concentration is found unnecessary but a titration for acid is made every one or two days.

Anodes of electrolytic nickel sheet are recommended for this solution. With the rolled or cast type an insoluble black material was found to accumulate on the anode and in the solution. Using the electrolytic sheet anode, however, no sludge or slime occurs and the solution remains almost crystal clear. The anodes should be withdrawn when the solution is idle.

Tests for Adhesion

Before describing the effectiveness of this method it seems wise to indicate the degree of adhesion obtained, by mentioning the tests used. These include; (a) one equivalent to ball burnishing; (b) heating to 1200°F; (c) bending on thin sheet and wire; (d) one in which a layer approximately twice the thickness of the deposit is lifted with a small chisel or graver and subsequently pulled away from the basis metal. The fracture is then examined under 40X magnification. Imperfect adhesion is readily apparent in this test, showing as a small V-shaped exposure of the basis metal beyond the fracture, when the adhesion is nearly "perfect". When satisfactory adhesion is claimed, it infers that it has been found "perfect" under each of these tests.

To obtain this degree of adhesion on stainless steel, organic matter is removed in the usual alkaline cleaner after which the work requires only the nickel treatment described. It is, however, as important as usual that no greasy film remain on the work and that no soap carry over into the acid solution. No other precautions need be taken.

Comparison with the Gardam Method

This solution, which for convenience may be called a nickel strike, is closely analogous to the Gardam method, but it has been found preferable in certain respects. Primarily it gives better adhesion unless the Gardam operation is preceded by a hydrochloric acid etch. Such an etch requires perhaps 3 minutes and slightly increases the finishing problem in the final plate. Also, where ordinary steel and stainless are present together, unsatisfactory etching occurs and adhesion is poor or absent. To obtain adequate adhesion with the Gardam method a high current density is necessary. This fact coupled with a comparatively low order of throwing power* has been found responsible for poor adhesion in recessed or remote parts of the work. With the nickel strike, not only is better throwing power obtained, but adhesion is found to be practically independent of current density. With the Gardam solution a treatment of 5-10 minutes is specified and necessary, while the nickel strike requires at most 2 minutes.

*"Throwing power" is used here without consideration of its strict meaning.

Finally, two disadvantages connected with the high current density (150 amperes per square foot) specified for the Gardam method, are not encountered with the nickel strike. It is necessary to operate the Gardam solution from a 12 volt line, and special attention is required in racking to handle the large current. The lower current required by the nickel strike is obtained from a 6 volt line and being comparable to that used in electric cleaning, presents no unusual racking problem.

Use for Combination of Metals

In addition to its efficacy as a treatment for stainless steel the nickel strike has been found useful as a preliminary operation, especially where two or more metals are present on the same piece of work. Where such combinations are processed it is rarely possible to obtain even passable adhesion on both or all of the metals present, using the ordinary cyanide or acid dip for the removal of oxide. This is probably due to the fact that in each solution in the cleaning cycle the differing metals become, in effect, the electrodes of an electrolytic cell, even though intimately in contact with one another. One of the metals acting as anode, acquires an oxide coating under these conditions and such a coating need not be water repellant or visible to prevent adhesion. This sort of oxidation may occur even in a solution such as cyanide or acid, used specifically to dissolve oxides.

This situation is ordinarily handled by making the work the cathode in each solution of the cycle. When this is done the combination of metals is held at a cathodic potential, large in relation to the potential differences involved in the cell effect, and the tendency to anodic oxidation of one of the metals is minimized or eliminated.

Reducing Oxides

Another effect of cathodic treatment is the possibility of counteracting the slight oxidation which may have been present before treatment or which may have developed during a carry-over, rinse or other non-electrolytic part of the cycle. This possibility (and it is only a possibility) is that the oxide is reduced to the metal by the cathodic current or the nascent hydrogen resulting from it. In such a case the chemical solubility of the oxide is not involved, no metal need go into solution, and no etching of the metal need occur.

The nickel strike has proven unusually useful as a medium for reducing oxides in this manner. It has the added advantage that a coating of nickel occurs in the same operation. This deposit covers the dissimilar metals, ending the problem of the cell effect and insuring against oxidation from this source.

Prevention of Carbon Smut

In plating on steel the nickel strike has been found to insure good adhesion and to eliminate the possible problem of carbon smut. It is well known that when steel is subjected to an acid dip to remove oxide, the metal itself is slightly attacked and the carbon present in the dissolved layer left free on the surface. Ordinarily the small amount of carbon involved is not objectionable, but in bright plating it may cause a slight dulling and there is a possibility that porosity may be traced to this source (among others). Using the nickel strike, no solution of the steel is evident and perfectly clear bright deposits are obtained. It has been observed that the thin nickel deposit resulting from this solution has a protective value on steel, seemingly out of proportion to its thickness. It is possible that an ordinary nickel deposit would have greater protective value if preceded by the nickel strike. This possibility appears to warrant investigation.

Where the steel is cleaned in a soapy cleaner before the treatment in the nickel strike, it has been observed that a film can result which the nickel strike is incapable of removing. This has occurred infrequently and appears to be associated with slight corrosion of the steel in humid weather. Probably ferric ions are present on the surface of the steel when it is introduced into the soapy cleaner and iron soap results. Whatever its nature, it has been found convenient to take care of it by a dip in 50% hydrochloric acid followed by anodic treatment in cyanide, after which the nickel strike acts satisfactorily.

Use on Nickel Silver

It is customary to precede the deposition of silver on nickel silver with a deposit of nickel. An operation requiring 30 seconds in the nickel strike is found to give the benefits obtained from a much longer treatment in the ordinary nickel solution. It gives in addition, an insurance of adhesion not obtained by the use of a cyanide or acid dip before the ordinary nickel deposit. This applies as well if brass or copper is the basis metal.

When nickel silver or brass is bright-dipped and plated with bright nickel or bright silver, the structure of the basis metal appears macroscopically in the deposit. This prevents the normal brightness of the deposit and makes finishing necessary and difficult. By following the bright-dip with the nickel strike this effect is eliminated when silver is deposited. It may be found to act similarly for bright nickel.

For thin deposits on non-ferrous metals, for coloring, or other purely decorative effects the nickel strike compares favorably with the usual plating solution and eliminates an operation in the cleaning cycle. The low efficiency is offset by the higher allowable current density, and a very rapid cycle is available if desired.

Thick deposits can be obtained from this solution and are a little similar to those from the ordinary chromium solution. They take their initial character from the basis metal appearance, remaining entirely bright on a smooth surface, up to a thickness of about .0001". Above this value they gradually become milky and then soft matte. On a mirror-finished basis metal no reduction in brightness is noted after the two minute treatment used on stainless steel. No tendency to brittleness has been encountered in the heaviest deposits observed (about .001"), but at this thickness pitting may occur.

Other Possible Uses

The applications described have been proven by use in production. Others which may be of interest or value but which have not been well established, include (a) plating on old or passive nickel; (b) plating on chromium plate; (c) plating directly from a vapor degreaser.

It is of theoretical interest to compare the nickel strike with the cyanide copper flash, regarded so highly by some as a preparatory deposit. These appear to have much in common and it is not unlikely that observations on each will contribute to a fuller understanding of both.

The Modern Electrotype Industry

Reproduction by electrodeposition as practiced in two up-to-date plants—the Flower Electrotype Company, New York, and the Reilly Electrotype Company, New York.*

AN ELECTROTYPE is defined by Webster as "a metal facsimile of any surface, as of a die or an engraved plate, made by electrodeposition, and used for printing." Hence, electrotyping is a process of duplication, which produces any desired number of metallic printing surfaces, and each of these is similar in detail and dimensions to the original surface.

Uses

The finished products are in almost all cases used by the printing and advertising industry. The most important applications of electrotypes, within these industries are:

(1) For use by the letterpress printer;

(2) As a pattern plate of type setup for books etc., to be stored for future needs; for molding other electrotypes;

(3) For newspapers; stereotypes which are used in the actual printing are made from the electrotypes.

One of the minor applications is the production of duplicate embossing dies from brass dies. The electrotype duplicates are used for embossing cigar bands, calendars, etc.

The subject from which the electrotype is made generally consists of a form of type or an engraving. The first step in the production of an electrotype is to wash the original with a cleaner, such as gasoline or benzine, to remove any dried ink and to clean it thoroughly. The original is then planed and warmed to the proper temperature for molding—about 100° F.

Molds

Three types of molds are in use by the industry at present: the wax mold, Tenaplate, and the lead mold. Originals, suitable for wax mold or Tenaplate, include type forms, and zinc or copper photoengravings, or a combination of type and photoengravings. Due to the high pressures required for lead molds, type or photoengravings mounted on wood cannot be employed. Instead, unmounted copper photoengravings are used. Lead molds are principally used for printing special high grade half tone or color process work.

The wax molding case consists of a flat metallic sheet, coated with a layer of wax, approximately ⅛″ to ¼″ thick. Ozokerite and mixtures containing beeswax, gum turpentine and some of the vegetable waxes are used for this coating. The metal case is laid on a steam-heated table, and the melted ozokerite or wax poured on and allowed to solidifiy. Prior to molding, the wax surface is made smooth and flawless by removing a smooth cut in a shaving machine, and the surfaces of the wax and of the original are dusted with graphite to make the surface electro-conductive. The graphite also acts as a lubricant in molding, and prevents the wax from sticking to the original.

Tenaplate is a type of patent molding composition developed within recent years. It is supplied to the electrotyper in the form of a thin metal foil, coated with a plastic composition. The handling of Tenaplate is similar to wax or lead molding and it offers certain mechanical advantages for some types of work.

For lead molds, a pure soft-rolled lead is used. Since lead molds are conductive to electricity, they can be placed directly in the depositing bath without further treatment.

The operation of molding is performed in a very powerful screw toggle or hydraulic press, capable of exerting pressures up to 2000 tons or more. The original and mold, preheated to the correct temperature, are placed in contact in the press. Pressure is then applied, generally in two "steps"; the pressure is continued for a few seconds after the desired depth has been reached, to permit the wax to flow and set.

Building Up the Mold

Considerable skillful hand work is next required, to bring the wax mold

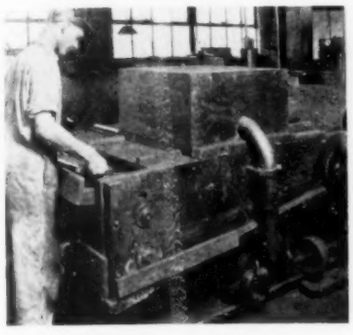
*For information contained in this article and for permission to go through the plants of these companies, grateful acknowledgement is made to Alfred R. and Walter C. Flower, of the Flower Electrotype Company, and Joseph Reilly, president, Reilly Electrotype Company. Illustrations were supplied by the Flower Company.

Molding.

Wax Mold.

Building.

to the requisite depth and height. The first operation, "cutting down," is done with a sharp warm knife and removes excess wax to the level imprinted by the shoulders of the type. Loose bits of wax are brushed and picked out, and the sharp edges left by the knife are rounded off by flashing with a small gas flame. To insure the proper clean non-printing depth in the electrotype, the corresponding parts of the mold must be "built up"



Wet graphiting.

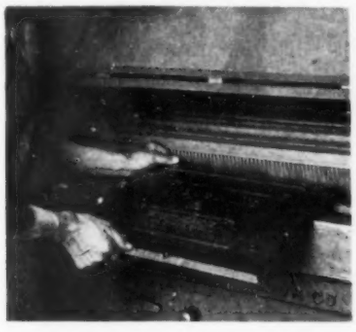
and this is done by flowing melted wax with a heated pointed building iron. The operations just described are done by the molder's assistant or "builder." (The built up sections are, of course, depressed in the finished electrotype).

Sensitizing the Mold

The wax mold or case is next prepared for the electrolytic depositing bath. The surface of the wax is made conductive by applying a thin continuous film of graphite. Two types of equipment are in use: dry graphiting machines and wet graphiting machines. In the former, the dry powder is distributed by soft fine brushes that move up and down, as the mold moves back and forth beneath them. In the wet machines, graphite and water are mixed to form a very thin paste and sprayed over the face of the mold, as the latter is conveyed through the machine. The wet process is said to give superior results, as the pressure causes the graphite to penetrate the finest details of the mold. The case is then well washed with water, and those portions of the graphited surface on which it is not desired to electrodeposit are "stopped off" with wax.

Electrodepositing Copper or Nickel

Molds from which copper electrotypes are to be made are given a thin preliminary deposit of copper, to improve the conductivity of the surface and increase the initial speed of electrodeposition. This preliminary deposit is formed by sifting fine iron filings over the wet graphited surface, adding copper sulfate solution, and agitating with a brush. The surface is then thoroughly rinsed. The preliminary deposit of copper is omitted when nickel electrotypes are to be made, as



Dry graphiting.

the copper would contaminate the nickel electrotype bath.

Several advances have been made in recent years in the equipment used for electrodeposition. Larger and much more efficient generators are now employed, and for nickel electrotypes, a separate generator is generally used. Wooden tanks, tied with steel rods, and lined with pure sheet lead have been in general use and more recently rubber lined steel tanks are finding favor. Temperature of plating solution is controlled by submerged lead pipes, carrying steam or cold water. Agitation of the solution is accomplished either by circulating with a pump or more generally by means of compressed air, which is distributed from perforated pipes at the bottom of the tank. The plating solution is kept clear and free from sediment and sludge by filtration.

Copper is electrodeposited from an acid copper bath (copper sulfate and sulfuric acid), of approximately 20° Baume. A suggested formula given by Blum and Hogaboom* consists of 33 oz. copper sulphate and 10 oz. sulphuric acid per gallon of water. Anodes are pure electrolytic copper, in the form of plates or bars. Current at four to eight volts is usually used. To obtain a copper shell of sufficient thickness and density of structure, the electrodeposition requires from two to eight hours.

Nickel electrotypes are known in the trade as "steel faced" or "nickeltypes." They are employed by the printer where increased durability for long runs, rough stock, or resistance to the corrosion of colored inks demands their use. Hundreds of thousands of impressions can be made from a nickel electrotype. A suggested formula† for the nickel bath is: single nickel salts, 9 oz.; ammonium chloride 0.7 oz.; water 1 gal.; pH 5.7; temp., 68-86° F.; current density 9 to 19 amps. per sq. ft.; for wax molds electrolytic nickel anodes are used. The wax mold remains in the nickel bath until a shell of nickel has been electrodeposited and is then transferred to the copper bath. Here the nickel shell is reinforced with electrodeposited copper to the desired thickness. The copper reinforcement is needed, as the nickel shell cannot be backed with type metal. As in the case of copper electrotypes, speed of production of nickel electrotypes is most important, but no attempt is made to obtain color or lustre in the nickel deposit. For satisfactory operation, chemical control of plating solutions is highly desirable,

*"Principles of Electroplating and Electroforming" by Blum & Hogaboom, 1930 edition, page 216.

†"Principles of Electroplating and Electroforming" by Blum & Hogaboom, 1930 edition, p. 260.

Placing case in the bath.

Releasing shell from mould.

The shell. (Back)

The shell. (Face)

Casting.

and some large electrotyping establishments require the full time services of a chemist. Sets for titration of copper solutions and pH tests of nickel baths are in general use.

When a shell of suitable thickness has been electrodeposited, the case is removed from the bath, and boiling water is poured upon the shell, releasing the wax mold. This operation destroys the face of the mold and prevents its reemployment in the plating bath. The stripped wax is remelted and used indefinitely for new cases, and the discarded lead molds are sold to lead smelters.

Backing Up the Shell

Next, the face of the shell is cleaned, the rough edges are trimmed off and the shell is placed face down on a rimmed flat plate of iron called the "backing pan." The reverse side of the shell is coated with a liquid soldering flux, known as "backing fluid," and strips of solder in thin sheets, known in the trade as "tin foil," are placed over the entire back of the shell. The backing pan and its contents are floated upon a bath of molten electrotype metal, which transmits its heat to the foil, melting it and completely "tinning" the reverse side of the shell. The pan and contents are then transferred to a level table, called the "backing stand," and molten electrotype metal poured on to a depth of about ¼ inch. The metal is poured at about 650° F., the temperature being determined by a pyrometer. The pan is then cooled by directing cold air from a powerful fan against the lower side.

The standard formula for electrotype metal is 94% lead, 3% tin, 3% antimony, but this composition varies at different plants, depending upon special requirements.

The shell and backing, now known as the "cast," is allowed to cool and then scrubbed by machine with a cleaning agent. This is followed by an additional cleaning with boiling water and live steam. The cast is then cut up into its individual jobs, and the dead metal removed by means of a circular saw. Most of the excess metal is next planed from the back of the cast in a machine called a "rougher."

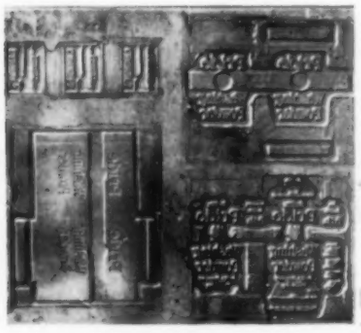
Truing Up the Cast

Due to the shrinkage of the cooling metal and other causes, the printing face of the cast is frequently not true and plane, and this condition is remedied by the finisher. The operation is known as "leveling" or "finishing" and is usually done by hand, with a set of punches and tools, although it can be carried out to some degree by machine. The cast is now brought to the desired thickness by removing thin shavings of metal from the back, in the shaving machine. To obtain the proper depth between the printing and non-printing levels of the electrotype face, some of the metal must be cut away. The operation, known as "routing," is performed in a special machine; the routing tools are of various sizes, and are held in a revolving vertical spindle that can be raised or lowered by the operator.

If the electrotype is to be used on a rotary printing press, it must be curved to an accurate fit. The curving is done by passing the electrotype plate back and forth through bending machines.

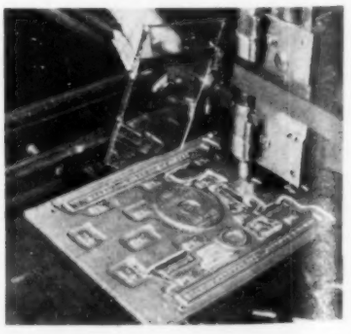
Finishing the Electrotypes

Excess metal and "bearers" on the sides of the plate are now removed in a trimming machine. If the electrotype is to be used on a "patent block" a shoulder, bevelled at the correct angle, is cut in a special machine. The "patent block" is an accurately machined base of iron, steel or aluminum alloy to which the electrotype is firmly



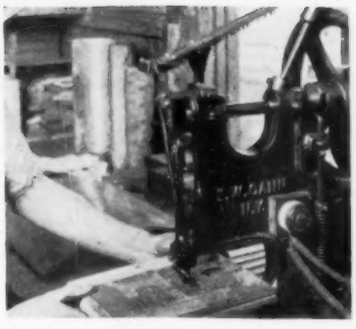
Cast plate.

Hand finishing.



Routing flat plate.

Beveling.



Nailing on wood base.

clamped. The insertion of type matter or of another electrotype section, in an electrotype plate is accomplished by "mortising"; this consists of cutting out part of the electrotype with a combined drill and jigsaw, and finishing by hand.

In some cases, the electrotype is mounted on a wood base, to which it is fastened by machine nailing, hand nailing, screws or "metal anchors." Cherry, mahogany, birch or maple may be used for the base. The mounted electrotype is finally brought to the correct height (.918") by taking a cut from the wood base in a special planing machine. This is known as "type highing."

As a final check on the quality and accuracy of the finished electrotype, it is inspected and a proof taken in a printing press. It is then compared with the order and packaged for shipment.

The requisites for successful operation in the electrotype industry of to-day are speed and reliability. Rush orders are usual and the electrotyper must deliver on time. This often necessitates duplication of equipment and additional personnel, in order to provide for the peak loads that the electrotyper must meet.

Magnetic Method for Measuring the Thickness of Non-Magnetic Coatings on Iron and Steel

By **ABNER BRENNER***

A nondestructive, magnetic method is described for measuring the thickness of nonmagnetic coatings on steel. The instrument used is similar to that previously described for measuring nickel coatings on nonmagnetic base metals. The present method depends on the decrease in the attraction of a permanent magnet for steel when the two are separated by a nonmagnetic coating.

Measurements on commercial coatings of which the actual thicknesses were determined by standard methods yielded results that were accurate to plus or minus 10 per cent for most coatings. The results were about 25 per cent low for hot-dipped tin coatings, which are only about 0.0001 in. thick.

Because nickel is less magnetic than steel, the thickness of nickel coatings on steel can be measured by this method, using a suitable calibration curve.

*Research Paper RP1081 National Bureau of Standards, Washington, D. C., obtainable from the Superintendent of Documents, price 5 cents.

Stop-Off for Tin

Q.—I wish to stop-off part of article and then apply tin. Must stand temperature of 700 deg. F.

A.—It is doubtful if you will find a stop-off such as commonly used by the plating trade that will withstand the temperature requirement. Most of these stop-off materials are of a lacquer type. For detailed information on these consult lacquer manufacturers the names of whom can be found in the METAL INDUSTRY advertising section.

A procedure you might try is to tin coat the article in question and then stop-off the parts desired to retain the tin. Then dissolve off the tin on the exposed portions. A solution of hydrochloric acid will effect this. The lacquer stop-offs referred to above can be used. These can be removed with thinners.—G. B. H., Jr.

Yellowish Nickel

Q.—I am sending two nickel solutions for analysis. How can I overcome the yellowish appearance of the buffed nickel?

A.—The analyses of the solutions are:

	Still tank	Barrel
Nickel	3.72	3.99 ozs./gal.
Chloride	2.97	4.51 ozs./gal.
pH	5.9	6.3

The composition of the still nickel is all right as far as the constituents shown above are concerned.

The pH of the barrel nickel is slightly high and this can be corrected by adding 3 fluid ounces of sulphuric acid to each 100 gallons of solution.

A yellow nickel can be due to excessive iron in the solution. Other impurities such as copper and lead in the solution will have a tendency to produce an off color nickel. Also, nickel will be stained by using a dirty or rusty hot water rinse. Hot water should be in a wood tank or an enameled vessel.

To remove iron from the solution treat with ferrous sulphate and hydrogen peroxide. Details on this procedure will be furnished if requested. —G. B. H., Jr.

Aluminum Boat

Aluminum goes to sea in the form of a lifeboat, built by Welin Davit and Boat Corp. for the United Fruit Company's S. S. Veragua. Advantages—light weight and freedom from painting.

Experimental aluminum lifeboat. (Courtesy Aluminum Co. of America)

Technical Control of Electroplating Processes

Control is absolutely necessary to economical operation. Various metal plates and the important factors to be controlled.

By **S. C. TAORMINA**

Technical Director, Platers Research Co., Brooklyn, N. Y.

THE effective control of electroplating processes really begins with the design and layout of the plating room. Effective control is obtained in the electroplating department or plant when production is up to par, never interrupted, and electro-chemical and chemical baths are always in balance; all of this, at the least possible cost in power, time and chemicals. The control factors in electroplating processes are:

1. Power and its proper use.
2. Instruments for electrical control.
3. Plating tanks, number and sizes.
4. Solutions and the proper standards.
5. Chemical analyses, equipment required and interpretation of results.

It is obvious to most of us that if, in the design of a plating plant, not enough current is provided for, production will lag, causing a disproportionate loss in time as compared with the cost and upkeep of a larger generator. But it is not so clear to many that actually poor plating will often result if the proper amount of current is not applied. Several specific instances are hot cyanide copper baths, cadmium and zinc solutions, bright nickel, chromium and rhodium. Furthermore, cathode efficiencies vary with current densities. Therefore, if a specified thickness of plate must be obtained, and the current densities are not high enough, the chances are that in most cases cathode efficiencies are overestimated. It has been our experience to find most plants undersupplied in the important essential of proper current. The table below provides a guide to the higher limits of current required for the various electrochemical processes, and may be used to determine generator sizes necessary.

Type of Bath	*Current Density in Amps./Sq. Ft.*
1. Acid electrolytic cleaner (Bullard Dunn type)	75
2. Alkali electro cleaner	50
3. Cyanide copper cleaning strike	50
4. Acid copper (electrotype)—warm and agitated	150
5. Acid copper (regular plating bath)	50
6. Cyanide copper (cold)	15
7. Cyanide copper (hot)	50
8. Cyanide copper (Rochelle salt type)—hot	75
9. Brass and bronze	15-3
10. Nickel—low metal (1 amp./sq. ft. per oz./gal. of nickel single salts)	15
11. Nickel — low metal baths (hot)	30
12. Nickel — high metal baths (cold)	30
13. Nickel — high metal baths (hot)	60
14. Nickel, nickel cobalt, bright metal baths — hot (usually high metal)	25-75
15. Nickel (electrotype)	20
16. Nickel die cast	15
17. Chromium (regular)	175
18. Chromium "hard" plating	300-800
19. Cadmium cyanide	15
20. Zinc cyanide	15-30
21. Zinc—acid	30
22. Silver	5
23. Silver strike	40
24. Gold	5
25. Rhodium	80-200
26. Tin—chloride	10
27. Tin—stannate	30
28. Black nickel	1-10
29. Anodic bath for aluminum —15 V. (sulphuric acid type)	30
30. Anodic bath for aluminum—50 V. (chromic acid type) up to	100

The above table is applicable mainly to still, semi and full automatic mechanical tanks, but not to barrel plating solutions. Current densities for plating barrels are better estimated for production purposes on the basis of a pound of material, having first calculated the surface area presented by 1 pound of work. Current density will range from 1 to 5 amperes per pound depending on gauge of work, size perforations in cylinders, speed of the barrel and temperature. The average barrel will hold from 75 to 150 pounds per work. While it would seem that 1 to 5 amperes per pound of work is low, actually only a small part of the surface to be plated in a barrel is being plated at a given instant. Therefore, the current density on that surface is very high. This is possible, of course, because of the fact that the solution is being agitated by the revolving barrel.

It is very difficult to obtain bright deposits and to control the nature of such deposits in barrel plating solutions, supplied with only 6 volts or less.

If proper current densities are important in the control of electroplating processes, it would logically follow that the instruments for recording and distributing the current are just as important. Most tanks are usually equipped with voltmeter and rheostat, but only in few cases with ammeters. All these instruments are required if proper control is to be maintained. The voltmeter indicates the voltage drop or conductivity of the solution. The ammeter, the amount of current; and from that and the area of work—the average current density being applied. The rheostat helps to control the amount of current applied.

Until a few years ago, instruments were not considered important in the plant. This was due to the fact that simple solutions were used, and no specifications were imposed as to thickness of plate. Where, for example, 100 amperes might have been applied, only 25 or 50 were used. Production was not as highly geared as it is today. Now, however, every step in a plating room is timed and geared for mass production. Every ounce of power available is used and controlled. High metal, hot plating baths make high current densities possible. A space occupied by a 500 gallon tank formerly accounted for 20 pieces per hour. The same tank, i.e., the same space, now is required to turn out 200 pieces per hour. Addition agents are used for bright deposits, and to impart other characteristics to the plate. If the current applied is not controlled, the desired characteristics of the plate cannot be obtained.

The size of a tank should be determined by the amount of work to be plated per batch. A tank capacity of about one gallon per ampere to be used has been found in practice to be adequate for most baths, and is a safe figure when in doubt. However, for more exact estimates, the following factors should be considered; besides the quantity per batch:

1. Nature and size of pieces to be plated.
2. Nature of the bath.
3. Time of plate.
4. Plate out.
5. Drag out.

These factors influence the length of time before a solution requires replenishment. When the tanks are operating at full capacity, it should not be necessary to make additions more than once daily. Daily replenishments should include only such chemicals as addition agents, brighteners, and chemicals necessary for pH adjustments. Other additions, such as plating salts, should be made once weekly. In determining the size of tanks necessary, these factors should be remembered.

Installing Control Methods in a Going Plant

Most of the control problems center in already existing plants. Here the problem is chiefly one of best adapting what is on hand to the requirements. But in every plant there is a certain minimum amount of testing equipment and number of instruments required to make the most effective use of the plating equipment. When the total plant investment is considered, electrical instruments are not expensive and can be easily installed. All tanks should be supplied with ammeters, voltmeters and rheostats. Chemical analytical sets which permit rapid analyses of plating solutions are available on the market today at very reasonable prices.

The very first consideration to insure the proper control of current in a plating room is to make certain that the generator is producing its rated amperage. If not, it should be checked for faults and adjustments made. Bus bars should be of adequate size to carry all the current available. Connections must be kept positive and clean at all times.

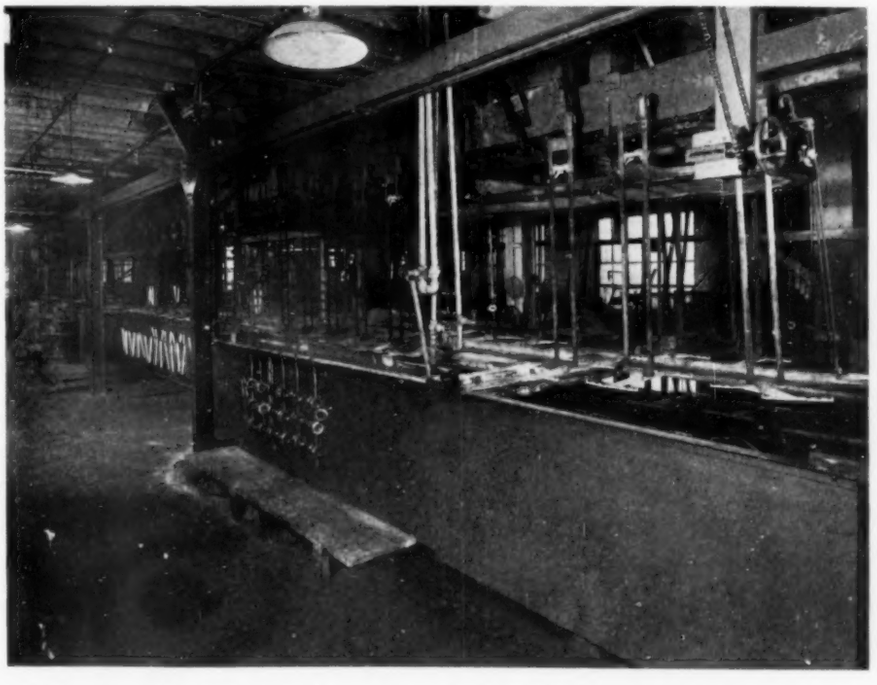
A careful study of the production requirements should be made in order to properly route the work through the various tanks. This will help in determining the current necessary for each tank load and give data concerning the ampere hours of electrolysis, which in turn serves to note replenishment intervals.

No tank should be kept idle if there is an adequate supply of current to keep it filled with work. New tanks should not be added to the plating room if there is not an adequate amount of current available. In the first instance the more tank space used the less control required. In the latter case, additional tanks with an insufficient supply of current will throw off results in all the tanks. It is not uncommon to see electrolytic cleaners, and hot fast plating baths added to the plating room without adding to the available current.

Control in the plating room is generally thought of as merely chemical analysis of a bath and then replenishing. As we have shown above, other factors have a distinct bearing on the subject, although chemical control is important and essential.

The average plater, with only the fundamentals of analytic chemistry, can very easily make periodic analyses as required. The most rapid check is a specific gravity or Baume reading made with a hydrometer. However, this method is of value when there is only one main component in a solution. (An example of this is the chromic acid bath). Baume readings are not recommended for solutions that have more than one chemical as the main component.

There are on the market today analytical sets for practically every commercial plating bath, which any plater can use. Every progressive firm should either supply a chemical set



Full automatic plating machine at the S. K. Williams plant, Milwaukee, Wis.

to its plater, or have the solutions analyzed periodically by a chemist. *Plating bath standards in the modern plant cannot be maintained by guesswork.*

Plating Solutions

Why should a particular standard or formula of plating solution be adopted, and what determines the standard? The standard to be adopted is determined by the production requirements and equipment available. Standards should be established so that control of the solution is accomplished as easily as possible. The ideal standard for a plating bath is one that is not critical to temperature changes, has a high cathode and anode efficiency at any current density, always gives the required smooth or bright deposit, and never requires any attention or additions. No such bath exists.

The standard to be adopted is the one that most closely approaches the ideal plating bath. This is particularly true today, when a plater has all he can do to keep up with the production requirements of his department. The simpler the bath, the better. Chemicals or addition agents should be used that can be controlled either by ampere hour calculation or chemical analyses. In setting the standard, keep well within the critical limits, so that additions greater than required, or plate-out and drag-out losses do not affect the quality of plate. But as long as the instruments of control are available, no plater ought to hesitate in using any bath, no matter how complex, providing it meets the requirements.

This article will be concluded in an early issue.—Ed.

Drying Before Lacquering

Q.—We make lacquered brass goods. Recently we have been sold on the idea of taking our brass work from our last cleaning operation which is a hot water rinse, immersing it in a "precipitating thinner" and then immersing it in the lacquer. We have been told that the precipitating thinner washes off all the water that comes out of the hot rinse and that there is no necessity for drying the work before lacquering.

However, there seems to be a difference of opinion as to the value of the precipitating thinner and as to its effectiveness in entirely removing water. Please give us what information you can on this subject.

A.—Precipitating thinner is effective in removing moisture from work provided that the operation is carried out with care. If a hot water rinse is used and the articles have sufficient weight, it is possible that they will dry off and stain before being placed in precipitating thinner. To insure good results, a cold water rinse should be used and sufficient time allowed in the precipitating thinner so that water may be thoroughly removed from surface of article.

The tank holding the precipitating thinner should be so designed so that water may be drawn off at frequent intervals from bottom. If large quantities of work are involved, the tank should be of sufficient size to hold enough thinner so that it does not become contaminated with water too quickly.—T. H. C.

Nickel on Tin or Lead Alloys

Q.—What are the steps necessary for plating nickel on pewter, lead, solder?

A.—Most of the trouble which comes from peeling when applying nickel over lead, pewter or solder is due to over-cleaning or over-pickling.

It is advisable in handling this type of work to remove as much as possible of buffing dirt and grease by wiping with clean cloth. Then scratch brush to remove oxide films, using soap bark in water and keeping the work and wheel well wet.

Rinse and then give a light cleaning in any of the alkaline cleaners that can be purchased for this purpose from manufacturers of platers cleaners. Advertisers in the METAL INDUSTRY will supply information on this.

Rinse well, preferably in warm water to thoroughly remove soap film from the work. In many cases the work can then be given a light muriatic pickle (5% acid by vol.) rinsed and then directly nickel plated. In other cases it may be necessary to apply a cyanide copper deposit. In the latter instance, the free cyanide content of the copper solution should be low, not over about ½ oz. to the gallon, and the work should receive current as soon as it enters the solution. If this is not done, the metal, especially pewter, will be attacked slightly by the solution and a film produced that will destroy adhesion of the deposit.—G. B. H., Jr.

Aluminum Takes to the Water

The "Alumette"—a test hull on exposure to determine the serviceability of aluminum ship hulls.

New York City ferryboat "Gold Star Mother," built by United Shipyards, Inc., has about 55,000 lbs. of aluminum in its superstructure. (Courtesy Aluminum Co. of America)

Plating to Specification

A measure of quality. How to apply specifications and test commercial work for quality.

By NATHANIEL HALL
Chemical Engineer

SPECIFICATION plating was introduced to (or should we say forced on) the plating industry in the midwest by the automotive industry, and its effects are only lately being felt in the East, where the trade has not accepted it with any degree of enthusiasm. It was the desire for hardware and trim which would stand up as long as the rest of the car which started it all. An inferior finish on something like an electric iron is seen by very few people but an automobile travelling on public streets and highways is a perpetual advertisement for its maker. In the case of rusted bumpers which stand out like sore thumbs on a polished car, it may be a very injurious ad.

Quality and Specifications

Actually the silverware trade deserves credit for the introduction of quality plating, having practiced this long before automobiles were anything but rich men's toys. Note that the terms "quality plating" and "specification plating" are used interchangeably. Literally they are not synonymous terms, but in the trade, when we speak of plating to specification we mean quality specification. There are some cases where the term is used literally. One jobber I know is plating tubular furniture to "specification," calling for nickel, copper, nickel and chromium. No mention is made at all of how much thickness is to be deposited but the manufacturer insists that all four deposits must be put on. Of course with the use of a Rochelle salt cyanide copper solution, the first nickel plate is in most plants eliminated without any deleterious influence on the corrosion resistance. To this particular manufacturer, however, the specification of nickel as the first undercoat is specification plating.

Another example. One manufacturer called up one day and wanted to know whether he could advertise his silverware as "triple plate" which is a quality term indicating an average thickness of about 0.0003" of silver. He only had 15 minutes of silver on the article corresponding to about 0.0001" but he had a nickel plate and a copper flash underneath giving him three plates, so he thought that he could use a quality mark.

The three of four different deposits are a more impressive sales argument than actual thickness figures to the average buyer, but this type of plating to specification only evades the issue, because it is not designed to improve or maintain the quality of the finish. It only gives the consumer the impression of quality. But we are slowly getting away from that. The plater soon will have to produce a quality finish because the trade is becoming more and more conscious of it.

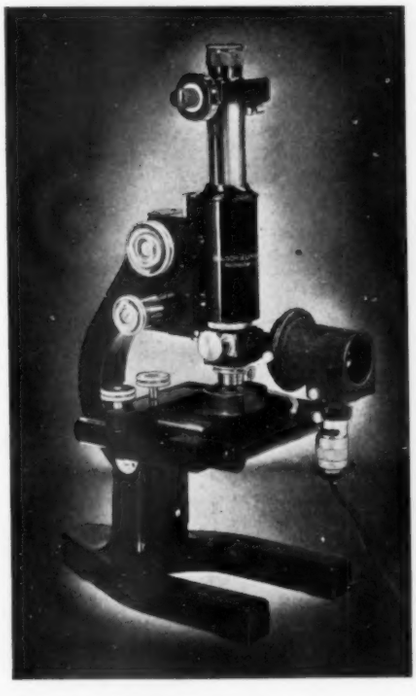


Fig. 1. *Electroplater's microscope. (Courtesy, Hanson-Van Winkle-Munning Co.)*

In view of the present tendency toward specification plating the plater must be prepared to do this type of work and this involves familiarity with the ways of measuring and controlling the thickness of the deposits.

Methods of Determining Thickness

The older method of determining thickness involved the stripping of the deposit in a suitable solution, determining its weight by difference, or more accurately by chemical analysis, and from the density, calculating the thickness. Sometimes, instead of weighing the article before and after stripping to determine the weight of the deposit, the basis metal was stripped from the deposit and the deposit was weighed. The latter method had the advantage of eliminating the error which is inherent in any determination of a small difference between large values. If the deposit was sufficiently heavy it was measured with micrometer calipers. The serious drawback to the stripping method was the measurement of the area of irregular objects which could not be done accurately without the expenditure of considerable time and effort. This was partly overcome by stopping off all of the surface except an area at least one centimeter square which was then stripped. Since an appreciable area was stripped in order to have enough metal for an analysis, average weights and thicknesses rather than spot thicknesses were measured and written into specifications, and even at present, quality silver plating is usually expressed as oz. of silver per square foot on holloware and oz. of silver per gross of pieces on flatware.

The newer methods determine the spot thicknesses at particular points rather than average thicknesses which are of lesser importance from the

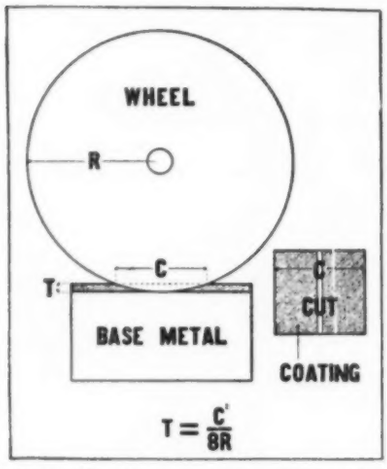


Fig. 2. Testing a coating on a plane surface with a grinding wheel. Mesle chord method.

standpoint of service. The most accurate of these is, of course, microscopic measurement. The cost of a microscope, light source, filar micrometer, polishing machine and incidentals such as holders and mountings is over $300 which in itself is not a serious drawback by any means. Its most important factor is the time and skill required. The article must be cut, mounted, polished, etched and measured, which procedure takes about 15 minutes. It is necessary to cut the specimen perpendicular to the deposit since the measurement of a slanting section will give erroneous figures. If the job is a large one, this method is probably best since subsequent loads of work can be plated either a longer or shorter time as indicated by the results. It must be remembered in connection with this procedure that the composition of the solution must not be allowed to vary appreciably since the throwing power, resistance or cathode efficiency might change and subsequent loads would then have different deposits. The microscope method is not advisable where small lots are plated, unless a compensating change can be made.

Mesle's chord method of measuring thickness is probably best suited to use in the average shop. This method requires a machinist's precision grinding wheel, to be used on flat surfaces, a flat file to be used on curved surfaces, a small instrument known as a spherometer for measuring the radius of curature of curved surfaces, a fine rule and a small magnifying glass. The article to be measured is ground or filed until the basis metal is just exposed. The width of the cut at this point is measured, the radius of the grinding wheel is known or the radius of the curved surface is read from the spherometer and using these two figures, the thickness may be calculated. The total time required is only two or three minutes and the apparatus is very inexpensive. The method is not as accurate as the microscope but is sufficient for all practical operations where the thickness is above 0.0002".

For deposits of cadmium and zinc the Hull-Strausser dropping method is very suitable and has been generally adopted for this purpose. A standard solution is dropped on the plated article until the basis metal is exposed and the time is noted. Each second is equivalent to 0.00001".

For thin deposits of chromium

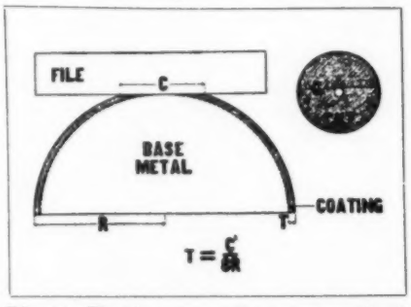


Fig. 3. Testing a coating on a spherical surface with a file. Mesle chord method.

which cannot be measured by the chord method or the microscope, a drop of HCl is placed on the deposit and the period of gassing is timed. At about 70 deg. F. each second is equivalent to one millionth of an inch.

A modification of the dropping method has been developed by Clarke, called the B.N.F. Jet Test, which as the name implies, uses a jet of solution rather than drops in order to corrode the more resistant metals like nickel and copper effectively and reproducibly. It is necessary to make corrections for the type of deposit such as bright nickels and one of the above mentioned procedures must be used to standardize this method.

A magnetic method has been developed by Brenner and is now being marketed, in which the force required to pull a tiny magnet away from the deposit is a measure of the thickness. This device must also be standardized. For non-magnetic deposits on iron and steel an electromagnetic device is on the market which records the change in magnetic permeability due to the thickness of the deposit. This device must be standardized for the various deposits. Both of these methods are unique in that they will measure the thickness on the article in question without destroying the finish. Of course the ordinary micrometer caliper with a vernier scale should not be forgotten; a very useful instrument for regular surfaces such as rods or sheets.

Every well equipped plating shop or department should have a certain amount of testing apparatus if specification plating is contemplated. A dropping test apparatus is essential for cadmium and zinc. It may be home made or purchased complete for less than twenty dollars.

For other metals, except thin deposits of chromium, a chord test apparatus should be assembled, including a spherometer, a No. 150 or No. 180 precision grinding wheel, a No. 6 flat file and a fine scale and magnifier; also costing in all about twenty dollars. For thin deposits of chromium the HCl drop test is satisfactory and entails no expense. Thus with an investment of less than fifty dollars a shop may be equipped to measure thickness on most articles with a satisfactory degree of accuracy. The drop test and the chord method require little time and no special training.

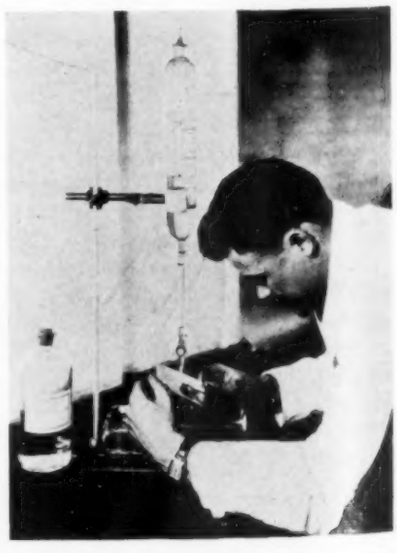


Fig. 4. Applying the dropping test. (Courtesy Hanson-Van Winkle Munning Co.)

The better equipped plant will also have a microscope and metallographic polishing apparatus which is relatively expensive and requires some skill and training but is adaptable to practically any measurement problem in connection with thick or thin coatings. For plants which have appreciable quantities of some particular type of work, an investment in a magnetic device may show economies and when the B.N.F. jet solutions are finally brought to the same degree of stability and reproducibility as the dropping test solutions, as they no doubt will be, this method may be substituted for the chord method for measuring nickel and copper. It might not be amiss here to emphasize again the need for chemically controlled, filtered solutions if adherent non-porous and thick deposits are to be produced economically, because thickness of coating, although most important, is not the only important factor in the production of a good deposit.

Applications

Having outlined the methods of determining thickness, we now concern ourselves with the problem of the plater, which is "when and how to use which method on what type of work." Quality specifications are drawn according to one of the following three requirements, each group requiring a different means of control and regulation:

The specification may call for a guaranteed minimum weight of metal per piece or per unit of area, usually per sq. ft. of surface. Precious metals are usually plated to this type of specification. In the old days the work rod was suspended from one arm of a balance and when the predetermined weight was reached the swinging of the balance opened a switch or rang a warning bell. This wasn't a bad method except, as you can well appreciate, the amosphere in plating rooms was not conducive to long life or continued sensitivity of delicate balances and in addition it was vulnerable to the previously mentioned error in the weighing of a relatively small difference between two large quantities, which is almost unavoidable. For a number of small pieces, weighing a sample at intervals is as good a method as any. For larger pieces a Sangamo meter is preferable. This device is mounted on the line and measures ampere hours which may easily be converted into units of weight from a table of electrochemical equivalents. If necessary a determination of the cathode efficiency should be made to calibrate the instrument. The meter not only reads the ampere hours but at a predetermined time may be made to ring a bell, flash a light or actuate a relay controlled circuit breaking switch.

The second type of specification calls for a guarantee of an average thickness of deposit as required. Non-precious metals such as copper, nickel, chromium, cadmium, zinc and tin are plated to meet this type of specification. When small lots are plated, the best procedure is to hang a small test plate in the tank with the load of work. After an interval which is somewhat shorter than the estimated plating time, the test plate is removed and the thickness is determined by any of the usual methods. Knowing the time and the thickness, it is a simple matter to determine by ratio the additional time required for the desired deposit. Thus if after 45 minutes the test plate has a thickness of 0.0009″, the work must remain in the tank for 5 minutes more if a 0.001″ deposit is desired. In the use of the test plate method the assumption is made that the articles and the test piece plate at the same rate even though the sizes may be different; or to put it in another way the same current density is maintained on each piece. Although not strictly true, this method works quite well in practice, if used with the proper precautions.

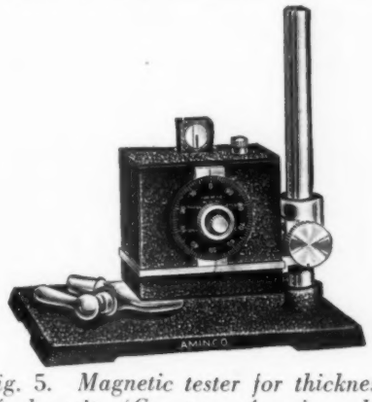


Fig. 5. Magnetic tester for thickness of deposit. (Courtesy American Instrument Co.)

A modification of this method which obviates the measurement of the thickness of the test plate, is to use along with the load, a test plate of known area and put this in series with a small ammeter. Then if the plate gets an average current density of let us say 10 amp./sq. ft. the assumption can be made, within limits, that the other work in the tank is plating at the same rate, and of course the required time can easily be calculated. An apparatus of this type called a current density meter was put on the market some time ago which has an immersed plug of known area connected with an ammeter, the whole apparatus being hung from the work rod along with the lot of work. The meter is calibrated to read in amperes per sq. ft. In using this method the cathode efficiency must be taken into account.

The specification for average thickness may not be satisfactory, especially in the case of complicated shapes which will receive a heavier deposit on the exposed surfaces and very little in the depressions, the actual proportions being a function of the throwing power of the particular solution. In such cases the third type of specification calling for a minimum thickness at designated spots (or "significant surfaces") is the correct one. There are no indirect means for determining spot or minimum thickness and an actual measurement of a sample piece must be resorted to. Of course, when the job is a large one and many tank loads of identical articles are plated, only an occasional check is necessary if the other conditions of deposition are controlled.

Specification Plating Elevates the Industry

With very little additional investment and with trained men the production of specified and controlled thickness of deposit should not offer any difficulty at all. Specification plating is nothing to fear. Once the plater has familiarized himself with this phase of the industry he can then acquaint even the small user of plated products with the advantages of quality plating and educate him to the point where he can draw up an intelligent specification. When this has been done plating will be raised from the present uneconomic plane to the level of a high grade technical industry.

Shop Problems CASTING • METALLURGICAL FABRICATION • ASSEMBLING • • PLATING • FINISHING

Questions from readers relating to shop practice and answers by our associate editors

Copper on Silvered Mirrors

Q.—Have you any knowledge of how copper plating over silvered mirrors is done?

A.—Copper plating of silvered mirrors for protection is being done, using an acid copper plating bath. There is considerable difficulty experienced in this type of plating and precautions are necessary in order to produce a satisfactory deposit. Thin adherent deposits are necessary as heavy deposits will strip silver from mirror. The thickness of plate required is equivalent to about .25 gram of copper to 1 sq. ft. of surface.

In the copper plating of the silvered surface, all loose adhering particles of silver must be washed free. It is important that silver be free from oxidation as copper will not adhere or it will tend to blister. Where articles to be plated are of intricate shape it may be necessary to use shaped copper anodes to obtain uniform deposits. If article is large it may be necessary to slightly rough edges of glass before silvering so that copper deposit may have a surface on which to bond firmly or otherwise copper may lift.

A bath made up as follows may be used:

ASSOCIATE EDITORS

T. H. CHAMBERLAIN
Director of Research Laboratory,
New Haven Clock Co.,
New Haven, Conn.

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Head, Plating and Polishing Depts.,
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Scranton, Pa.

G. BYRON HOGABOOM
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Newark, N. J.

W. J. PETTIS
Consulting Rolling Mill Engineer,
Lisbon, Ohio.

W. J. REARDON
President, National Alloys Co.,
Detroit, Mich.

H. M. ST. JOHN
Chief Metallurgist,
Detroit Lubricator Co.,
Detroit, Mich.

Copper sulphate	26 ozs.
Sulphuric acid	6.0 ozs.
Water	1 gal.

Temperature 75 deg. F., anodes, rolled annealed copper.

The current density to be used depends upon the article to be plated. It should be as low as possible so that no heavy copper coating is deposited. To be able to arrive at correct current density, will require a little experimenting.

The mirrored surface should be placed face down in bath so that no dirt or foreign particle will adhere to surface. A movable cathode bar should be employed so as to obtain a more uniform deposit.

For small size mirrors a clip similar to a battery clip is used for contact. They are usually covered with rubber and the jaws filed just enough to expose the metal for a good contact.—T. H. C. Problem 5,664.

Hard Chromium Plating

Q.—We have a chrome plating tank lined with 6% antimonial lead, 16" wide x 20" long x 14" deep. I would like to know how many and what size anodes to use?

Can chromium be successfully deposited on the bare steel or over cadmium; or should the steel parts be copper plated first?

A.—Hard chromium plating of tools for wear resistance is accomplished by plating directly on the steel surface.

Use this Blank for Solution Analysis Information

Fill in all items if possible.

Date .....

Name ..... Class of work being plated: .....
Address ..... City ..... State ..... Volume used: .....
Employed by: ..... Solution depth: .....
Kind of solution: ..... Cathode surface, sq. ft.: .....
Tank length: ..... width: ..... Kind of anodes: .....
Anode surface, sq. ft.: ..... Distance from cathode ..... Original formula of solution: .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible.

Use separate sheet if necessary.

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

Intermediate deposits such as copper are not satisfactory as this tends to reduce hardness and wear resistance of chromium deposit.

The size of the tank mentioned is quite small for ordinary types of work. A larger tank would be more advantageous and more satisfactory plating could be accomplished. A tank size of 24" wide, 30" long and 30" deep lined with 6% antimonial lead, would probably be more satisfactory. Six anodes 4" wide can be used on each side of tank. They should be at least 24" long. Suitable exhaust should be provided to remove fumes as they are a hazard and dangerous to the health of anyone operating the bath.

By writing to the Bureau of Standards, Washington, D. C., you will be able to obtain literature that is quite complete on the subject of chromium plating.—T. H. C. Problem 5,665.

Lacquering Brass

Q.—Please advise if you can give us any information regarding the finishing of brass cup hooks as inclosed sample.

A.—This finish appears to be a simple lacquer applied by spraying.

The hooks are placed on a board drilled with holes, and then sprayed. The board can be mounted on a swivel and then turned so as to cover all sides of the work.

For the type of lacquer and to obtain the desired color, get in touch with lacquer manufacturers, names of whom can be found in the advertising pages of the METAL INDUSTRY.—G. B. H., Jr. Problem 5,666.

Nickel on White Metal

Q.—Nickel solution for analysis. Wishes to plate direct on white metal.

A.—The composition of your solution is:

Nickel	4.44 ozs./gal.
Chloride	1.67 ozs./gal.
pH	6.2

For plating on white metal a lower nickel content would be preferable. A better content would be from 2 to 3 ozs./gal. of nickel.

This can be obtained by removing part of present solution and adding water. When this has been done, add the necessary amount of ammonium chloride to bring the chloride content up to 3 ozs. per gallon.—G. B. H., Jr. Problem 5,667.

Refinishing Hotel Ware

Q.—We have some questions on refinishing hotel ware.

1. Must work be stripped?
2. Copper flash before silver?
3. All other information.

A.—In general, the answer to the first question is yes. For information on methods of stripping you can consult articles by N. Hall which appeared in the May and June issues of METAL INDUSTRY.

Copper flashing is advisable if the work is old and pitted. Most hotel ware, however, is in a condition where a copper flash is unnecessary.

One of the most important points in refinishing soft metal objects is in cleaning. Excessive cleaning will cause as much trouble as insufficient cleaning as the metal is easily oxidized. After polishing it is good to remove as much composition as possible by wiping so that long immersion in the cleaner is not required. Use a mild cleaner recommended for the purpose by manufacturers of cleaners such as advertise in the METAL INDUSTRY.

Good results also depend on maintaining silver strike solution in good condition so that preliminary deposit is smooth and adherent. See Platers' Guidebook, page 25 for formula. Use carbon anodes with enough silver anode area to maintain metal in neighborhood but preferably not over ½ oz. per gallon.

—G. B. H., Jr. Problem 5,668.

Re-Rack from Nickel to Chromium

Q.—I am using a bright nickel solution. I was using the same rack for nickel plating as I used for chrome plating, and I gave the racks a rinse in an electro sulphuric acid strip tank before I used them in nickel again. I was advised against that practice on account of the danger of carrying chrome into the nickel bath.

A.—If chromium salts get into the nickel tank they will cause the solution to have a low efficiency and may prevent entirely the deposition of nickel. In addition even a small amount of chromium cause peeling.

Although your sulphuric rinse will reduce the danger of contamination it would nevertheless be on the safe side to re-rack work after nickel plating, for the chrome tank.—G. B. H., Jr. Problem 5,669.

Synthetic Enamel on Brass

Q.—We would like to have information on the finishing of sample pieces enclosed. We believe a synthetic enamel is used.

What treatment of the brass is needed, bright dip, sand blast or other method?

What treatment of the enamel, is a primer required, or if baking is needed?

What black filler to use, and how to apply? The filler on sample No. 1, appears to have been put on after enamelling, as the white can be seen if the color is removed from the numbers. On sample No. 2, the filler appears to have been put in before enamelling as we can see no trace of the white under the figures.

The adhesion of the finish on sample No. 1 seems to be better.

A.—The two samples submitted have been finished with a synthetic white enamel. The sample marked No. 1 has had a coat of baking white synthetic enamel while sample No. 2 is either a low temperature bake or an air dry synthetic enamel.

It is not absolutely necessary in order to apply synthetic enamels, to prepare the brass by bright dipping or sand blasting as long as the brass surface is clean. Bright dipping or sandblasting of the brass will produce a surface that is advantageous in obtaining a better bond. Trouble can be experienced in bright dipping if dip oxidizes the surface and if this happens, poor adherence will result. As a factor of safety it is well to dip work after bright dipping in a 20% solution of muriatic acid to remove any film.

Synthetic enamels manufactured today should give good adherence for type of work in question without resorting to the application of a primer. The use of a primer, however, is good insurance for best adherence but an extra cost is involved which seems unnecessary in this case.

The black can be applied after the white ennamel has been sprayed on and baked. Special oil blacks can be obtained which are rubbed on surface filling numerals and indicator marks and when almost dry the excess is wiped off leaving black in depressions. Such a black can be made up by mixing boiled linseed oil and lamp black to proper consistency to obtain a deep black.—T. H. C. Problem 5,670.

Metal Casting Digest

Short abstracts of articles of interest to practical non-ferrous foundrymen and metallurgists

By H. M. ST. JOHN
Associate Editor

Insulating Refractories: Their Manufacture and Physical Properties. G. A. Bole. Trans. Amer. Foundrymen's Assoc., Oct., 1937, page 261.

An insulating refractory is defined as "a product with low heat conductivity suitable for use as a lining for furnaces." The use of large shapes is advocated. Under tests and specifications the author takes up classification, size, suitability, load, reheat, shrinkage, heat flow, conductivity, porosity, spalling and strength. Properties of various samples are tabulated.

• • •

A Continuous Hardness Test: Periodic Hardness Fluctuations. Edward G. Herbert. Metallurgia, Sept., 1937, page 184.

A new hardness test has been developed which produces automatically a permanent record of hardness changes occurring in metals during ageing. The basis of the test is a scratch or groove formed in a slowly traversing specimen, rolled by a rotating ball. This test is shown to be susceptible to changes of hardness due to age-hardening, and the results are readily expressed in Brinell hardness. The continuous hardness test is used to investigate periodic fluctuations of hardness following magnetic and thermal disturbances.

• • •

Temperature Measurements in the Foundry. O. Brauer. Giessereipraxis, Vol. 58, page 290 (1937); Chem. Abstracts, Oct. 20th, 1937, col. 7372.

Two types of immersion pyrometer are described. The melting points and proper casting temperature are given for 13 nonferrous metals and alloys.

• • •

Nonferrous Alloy Castings; A Review of the Application of Nickel. J. O. Hitchcock. Machinery Market (London), 1937, No. 1913, page 27; Chem. Abstracts, Oct. 20th, 1937, col. 7372.

The relation of chemical and physical properties to nickel content in bronze, aluminum bronze, zinc alloys and silver alloys is discussed.—No. 1914, page 21.—Nickel-silver-copper alloys are considered in relation to traces of lead, tin, sulphur, zinc, cadmium, arsenic with respect to physical properties. —Same, No. 1915, page 23.—The properties of aluminum alloys containing nickel and cerium, copper, tin and chromium are reviewed.

• • •

Inverse Segregation (in Nonferrous Alloys). N. B. Vaughan. J. Inst. Metals (British), Vol. 61, No. 780, page 377 (1937); Chemical Abstracts, Oct. 20, 1937, col. 7373.

A review.

• • •

The Influence of Antimony on the Chemical Stability of Cast Aluminum Alloys. M. P. Slavinskii and N. T. Blinova. Metallurg. Vol. 11, page 95 (1936); Chemical Abstracts, Oct. 20, 1937, col. 7381.

Addition of 1% antimony increases the corrosion resistance of aluminum alloys.

• • •

Alloys of Aluminum with Copper and Tin. M. I. Zamotorin. Metallurg. Vol. 11, page 103 (1936); Chem. Abstracts, Oct. 20, 1937, col. 7381.

A phase diagram at room temperature for alloys containing up to 10% copper and 8% tin is presented. Tin decreases the solubility of copper in aluminum. Copper increases the solubility of tin in aluminum. Copper up to 5% increases tensile strength, but larger amounts decrease it. In soluble amounts tin has no influence on tensile strength or corrosion resistance. Both copper and tin increase machinability.

• • •

The Influence of Aluminum on Copper-Beryllium Alloys. Yu. A. Amsterdamskii. Metallurg. Vol. 11, page 90 (1936); Chem. Abstracts, Oct. 20, 1937, col. 7381.

Copper alloys containing beryllium 2% and aluminum 0.02-5.0% were investigated. Aluminum narrows the alpha field and increases the amount of beta phase present, especially at high temperature. Raising the quenching temperature increases the beta phase in alloys containing more than 2% aluminum but decreases it in alloys containing less than 2% aluminum. The narrowing of the alpha field at low temperature becomes less marked when aluminum is present, thereby decreasing the effect of age hardening. Aluminum increases the hardness, tensile strength and corrosion resistance of quenched alloys but decreases elongation.

• • •

Skill Needed in Brass Foundry. Pat Dwyer Foundry, Oct., 1937, page 28.

Describes the modern foundry and practice of the Atlas Brass Foundry Company, Columbus, O.

• • •

Gating Nonferrous Castings. N. K. B. Patch. Foundry, Oct., 1937, page 31.

Defines the terms used in gating practice and discusses the gating of several common alloys.

• • •

Developments in Non-Ferrous Alloys (Heavy Metals). D. K. Crampton. Metal Progress, Oct. 1937, page 569.

A review of recent progress including bearing metals and die castings.

• • •

Progress in Light Alloys. A. J. Dornblatt. Metal Progress, Oct., 1937, page 575.

A review of recent developments including the heat treatment of castings.

• • •

Notes on using Scrap in Aluminum Foundry Practice. R. Irmann. Aluminum, Oct., 1937, page 422.

Alloys of the Al-Mg and Al-Mg-Mn groups should not be mixed with copper-containing alloys. In mixing scrap containing magnesium with scrap containing silicon care must be taken to avoid too high a concentration of Mg_2Si which makes the metal brittle. Tests are described for determining the qualities of any given scrap mixture.

• • •

Re-Melting Aluminum in the Foundry. H. Rohrig. Aluminum, Sept., 1937, page 381, Oct., 1937, page 419.

German Exchange Paper to the Institute of British Foundrymen. Much more difficult to make use of aluminum alloy scrap than in case of copper alloys, because of the great variety of constituents which are mutually incompatible, difficult to distinguish and almost impossible to separate. The following factors are reviewed: Use of Fluxes; Phenomenon of Dross Incandescence; Oil Contamination; Furnace Design; Virgin Metal Additions; Quality Preservation; Corrosion Resistance; Degasifying Molten Baths.

• • •

High-Duty Brasses and Bronzes Available to the Engineer. F. Hudson. Metallurgia, Oct., 1937, page 195.

The demand for alloys to withstand severe service conditions has become increasingly insistent during recent years. The author discusses developments in brasses and bronzes to supply this demand. In this article attention is directed to various classes of high-duty brasses, and it is suggested that future development will center round those alloys capable of being hardened by heat treatment. These include beryllium copper (at present too expensive for many applications), aluminum bronze, manganese brass, silicon bronze, and certain copper-nickel-aluminum alloys, some of which contain substantial percentages of zinc. Tensile strengths up to 100,000 lbs. per sq. in. have been obtained, with Brinell readings ranging from 200 to 300.

• • •

Manufacture and Characteristics of Hiduminium RR Alloys. J. Towns Robinson. Metallurgia, Oct., 1937, page 201.

In this article, the second of a series, the author stresses the need for cooperation between designer and metallurgist, so that the application of each casting can be carefully studied and advantage taken of special characteristics of a particular alloy. The manufacture of castings is discussed with special reference to their soundness. (See previous abstract).

Modern Production Equipment

New processes, machinery and supplies for metal products manufacturing and metal finishing

Plating, Pickling and Cleaning Tanks

By **C. A. RAUB**
Maurice A. Knight Co., Akron, Ohio

The metal plating industry requires tanks which will not only withstand corrosion of acid solutions but also prevent contamination of the solutions and produce satisfactory plating. In addition, the tanks should be non-conductors of current to prevent electrical leakages which add to power costs and often result in material loss of the plating metals.

Tanks should be interchangeable and easily cleaned. Great economy in the number of tanks required can be effected provided the equipment can be used at any temperatures up to boiling and in any acid solution.

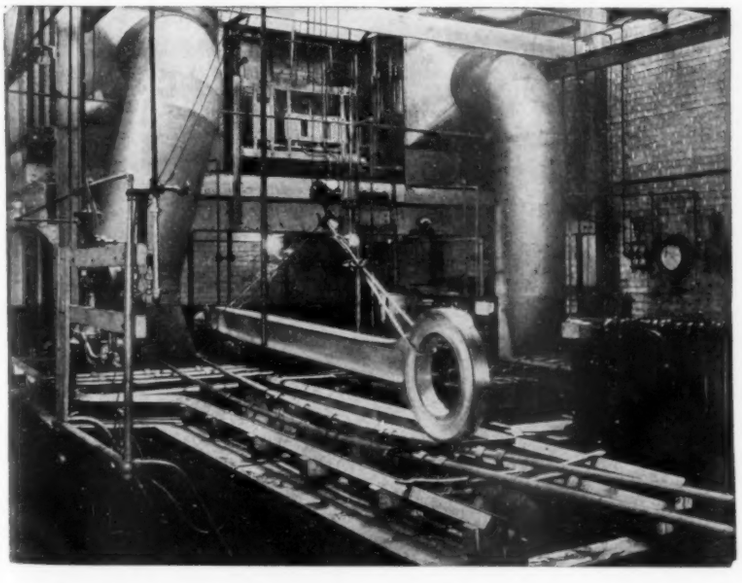
Knight-Ware acid-proof chemical stoneware is proof against all acids (with the single exception of hydrofluoric), at any rate of temperature used in pickling or plating of metal parts. Knight-Ware is acid-proof throughout the entire body and is not dependent on the surface glaze for its protection. It is made by Maurice A. Knight Co., Akron, O.

Pyroflex-Knight-Ware Construction

The steel or concrete tank is lined with Pyroflex which is a non-porous, non-aging acid-proof lining thermoplastic in character. Sheets of Pyroflex are fused to the tank walls and bottom and through outlets. Knight-Ware slab or tile is layed over the Pyroflex and joints made with acid-proof cement. The slab is made 12″ wide and in lengths up to four feet. Thickness of slab is 1½, 2, 3 and 4″. The 1½ and 2″ are solid and the 3″ and 4″ are hollow. Knight-Ware slab presents a smooth, hard finish with 90% fewer joints than brickwork. It is easy to install and the cost installed is only slightly higher than brickwork.

Knight-Ware acid-proof tile 8″ x 8″ x 2″ and Knight-Ware brick 8″ x 4″ x 2¼″ and Knight-Ware split brick 8″ x 4″ x 1⅛″ is fused to the Pyroflex lined tank walls and bottoms with joints between the tile or brick filled with acid-proof cement. This construction is strong. The tile or brick cannot become dislodged or loose and in addition the Pyroflex provides a cushion for absorbing mechanical shock or expansion or contraction due to temperature changes. Seepage of acid through the acid proof cement in the joints is stopped by the Pyroflex layer from attacking the con-

(Continued on page 346)



The front half of the main driving rod for the New York Central Railroad's "Commodore Vanderbilt" receiving a chromium finish in a Knight-Ware Slab lined steel tank. Courtesy of the Timken Roller Bearing Co.

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Safety Tube Stamp Holder. Designed to hold safety steel stamps securely during the marking of objects. M. E. Cunningham Co., 178 E. Carson St., Pittsburgh, Pa.

Ultraspeed Spot Welding; high production multiple spot welding equipment. Roth Welding Engineering Co. Inc., 17146 Mt. Elliott St., Detroit, Mich.

Busheling Alligator Shear; low-priced. Canton Foundry & Machine Co., Cleveland, Ohio.

Electric Lift Midget Hoist; steel cable type, heavy duty. Electro Lift, Inc., 30 Church St., New York.

New Drills—special duty; 5⁄8″, ¾″ and ⅞″ capacity; combine low speed and high torque. Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill.

One-Piece Cast Aluminum Fan Wheel; for blower fans with the hub cast to form the driven unit of a flexible coupling. Advance Aluminum Castings Corp., 2742 W. 36th Pl., Chicago, Ill.

Splash-Proof Motors; ventilation to assure low temperature rise; sealed ball bearings accessible for lubrication in all mounting positions. Diehl Mfg. Co., Elizabethport, N. J.

Large Hole, High Speed Resinoid Bonded Snagging Wheels. Circular steel flanges or plates permanently embedded and bonded into the sides of the wheel. Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.

A. C. Welder for Heavy Duty Service. Eliminates "hot spots" in the coils. Welding range from 10 amperes to maximum output. Giant Grip Mfg. Co., Oshkosh, Wisc.

Wax; Flexo Wax C.—high adhesion even on glass and metals. Glyco Products Co., Inc., 148 Lafayette St., New York.

Variable Speed Transmission. Ideal "Select-O-Speed", inexpensive, using only standard V belts. Ideal Commutator Dresser Co., 1941 Park Ave., Sycamore, Ill.

crete or steel outer shell of the tank.

Concrete tanks up to 101 feet in length have been lined with the Pyro-Slab construction. Pyro-Slab lined steel pickling tanks up to 67′ long x 84″ deep x 66″ wide are in service handling sulphuric acid pickling and nickel plating solutions. Fused on 1⅛″ thick split brick Pyroflex lined steel tanks are performing perfectly in bright nickel plating tanks and in chrome plating tanks as well as pickling tanks.

Chrome Plating Tanks

Knight-Ware slab lined steel tanks are now often used for chrome plating tanks. No Pyroflex layer is required. Care in welding the steel is extremely important. Electric shielded arc welding with Murex electrodes or equal is recommended with a "wash" weld over the inside joint. Pyroflex strip fused over the welds may be used as an added protection.

Steel tanks lined with Pyroflex and Knight-Ware slab, tile and brick have been shipped over rail and by truck without damage. The entire unit may be purchased complete provided the equipment will go on a railroad flat car.

Hydrofluoric Acid Pickling Tanks

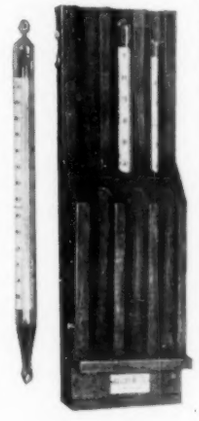
Since hydrofluoric acid attacks silica the inner lining is made of carbon brick set in Pyroflex or in sulphur carbon cement. The carbon brick should be fused to the side walls and bottom of the Pyroflex lined steel tank. The carbon brick is 9″ x 4½″ x 2½″ and can be layed either 4½″ or 2½″ thick. For most conditions the 2½″ thickness would be ample because of the adhesion to the Pyroflex and the resulting cushioning. A 2½″ carbon brick wall fused to the Pyroflex is stronger than a 4½″ wall set in acid proof cement and not fused to the Pyroflex.

Caustic Soda Cleaning Tanks

These are constructed same as Hydrofluoric acid tanks except no sulphur cement can be used. The joints between the carbon brick are filled with Pyroflex and the brick is fused to the Pyroflex lined steel tank walls and bottom.

Plating Room Instruments

The Kocour Co., 4724 S. Christiana Ave., Chicago, Ill., have for some years been specialists in plating room instruments and testing sets for solutions. Among the products which they manufacture are the small but essential instruments like thermometers and hydrometers. Their thermometer is of the floating type, reading in both Fahrenheit and Centigrade. Mercury is used in the column to eliminate fading and the clearly readable scale is enclosed so that it cannot be damaged by the solution.



Kocour floating thermometer, hydrometers and instrument case.

Hydrometers are of the streamlined type which come to rest quickly and can be easily cleaned. They have a double scale, reading in both specific gravity and Baume.

An instrument case is also provided for saving space in storage. It securely holds 3 instruments, can be wall mounted and is recommended as adequate protection against dirt or breakage.

Glass Cloth Anode Bags

It is generally recognized today a clean solution is absolutely essential for the deposition of the smooth nickel plate demanded by chromium, the universal surface coat. The chromium magnifies every imperfection, however slight, in the nickel undercoat. One method of keeping the solution clean is by continuous filtration, but this practice is not always feasible in every plant. Consequently other means have had to be developed.

The Hanson-Van Winkle-Munning Company, Matawan, N. J., manufacturers of electroplating equipment and supplies, were the first to offer muslin bags, and later, anode filter bags, in which the nickel anodes were placed. These bags effected a great improvement in the nickel deposits. Within recent years, however, it has become more and more general to use high speed, hot nickel plating solutions, with low pH (high in acid). The destructive action of the sulphuric acid shortened the life of the anode filter bags. Consequently the company has perfected a new type of anode container—the glass cloth bag.

This glass cloth anode bag, which was developed in cooperation with the Corning Glass Company, is of one-piece tubular construction, not sewed, but sealed by a special process at one end and protected from ravelling at the other end. It is flexible, not brittle, and will far outlast any cloth bag. The little extra care required in handling is not more than would be called for if it were made of strong parchment paper.

The glass cloth bag is recommended for all acid solutions and also for many alkaline solutions. All details are available from the Hanson-Van Winkle-Munning Company.

H-VW-M glass cloth anode bag.

Coated Cover Glass

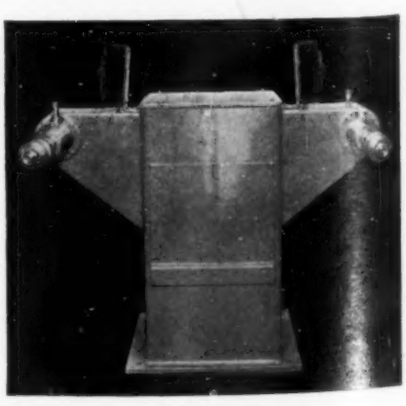
Immunity to pitting and resistance to heat plus clarified vision and ability to outlast ordinary glass 10 to 50 times, are a few of the advantages claimed for M. S. A. coated cover glass, as manufactured by the Mine Safety Appliances Company, Braddock, Thomas and Meade Streets, Pittsburgh, Pa.

Recommended for welding and cutting operations, M. S. A. coated cover glass is said to increase working efficiency and provide positive protection against molten sparks fusing to its surface, thereby obviating blurred vision, eyestrain and resultant inferior work. The new product insulates the shaded welding lenses against heat, and reduces costs by eliminating the need for frequent replacement.

Copies of a newly published bulletin describing M. S. A. Coated Cover Glass in complete detail, are available on request.

Double Arbor Polishing Lathe

The double arbor polishing lathe illustrated herewith has been placed on the market by the Crown Rheostat & Supply Co., 1910 Maypole Ave., Chicago, Illinois. This machine is a double face machine having two spindles, each spindle driven by an independent motor through a V-belt drive. Four men can be accommodated at this machine and it is also said to permit the greatest number of men to work in the smallest amount of floor space.



Crown double arbor polishing machine.

The lathe is equipped with two 3 h. p. motors and the floor space required for the complete unit is 48 in. x 55 inches. The distance between the centers of the two spindles of the unit is 48 inches. The distance between the centers of the two spindles increases slightly on a machine which is equipped with a 5 or 7½ h. p. motor. The spindles are overhung 13 in. from the base of the machine.

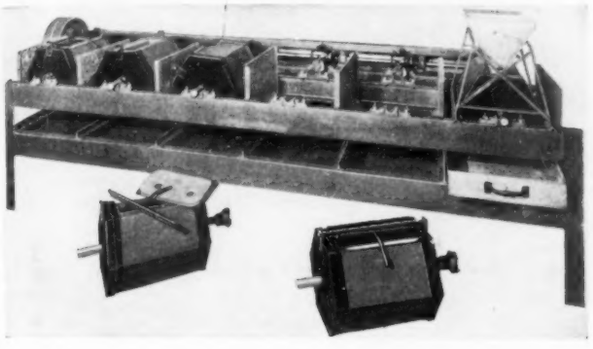
The motors can be serviced either through the top or through two side doors provided on the machine. The speed of the machine can be changed by merely changing the motor pulley. The spindles are mounted on ball bearings running in oil.

The unit illustrated herewith weighs approximately 1500 pounds.

Tumbling Machine

An improved type of tumbling machine has been developed by Munning & Munning, Inc., 202 Emmett St., Newark, N. J. Designed for durability and maximum operating economy, it is made in single and multiple units with tubs of standard size for either belted or direct connected motor drive. The frame of the machine is of all welded construction.

In the multiple units, each drum may be operated independently of the others and if necessary can be removed from the mechanism simply by lifting it out of its bearings without dismantling any parts or disturbing the balance of the installation. Loading is accomplished by a hopper placed over the drums, and for unloading the barrel is simply inverted and the work emptied into a double tray of the drawer type. The inner tray retains the finished work while the outer tray, which has a finer screen, retains the burnishing balls, thus effecting automatic separation.



Munning & Munning multiple unit tumbling machine.

In wet tumbling, the liquid used passes through a screened drain in the bottom of the machine.

The machine is recommended for wet and dry tumbling of the following types of work: chains, tubes, cups, pins, studs, pens, optical goods, jewelry, safety razors, novelties, curtain rods, dental tools, surgical instruments, watch crowns, household fixtures, ring settings, eyeglass frames and purse frames.

"Fishbone" Anode for Chromium

After two years of research and testing the Wellman Bronze and Aluminum Co. of Cleveland have introduced their new antimonial lead, "Fishbone" anode to the chromium plating industry. During this time tests made on this plating anode by both the parent company and one of the large automobile manufacturers, show that this new type anode produced better chromium plating at greatly reduced plating costs.

The anode is cast to custom length. The pattern is 3′ 2½″ long by 6″ wide x ½″ thick. The anode is 1″ thick at the solution. Hooks are of cast bronze with lead tin covering, and are cast intact with the anode. The weight, standard size is 21 pounds.

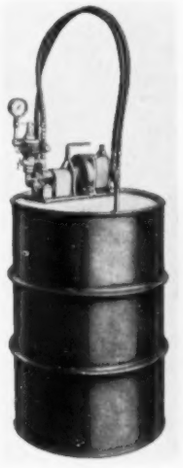
Cast instead of rolled, it has more edges than any other type of anode and offers maximum efficiency. This anode has four times the thickness of the average anode at the solution line. It is estimated that it lasts four times longer than the former anode.

The "Fishbone" Anode is patented. The national distribution is being handled through Fredric B. Stevens, Inc., Detroit.

Wellman "Fishbone" anode.

Fluid Circulating Pump

Binks Manufacturing Company, 3114-40 Carroll Ave., Chicago, Ill., has recently announced the production of a self-contained fluid circulating pump, operated by electric motor or by air motor drive. The new unit is designed as an economical and safe method of delivering clear lacquer and varnish, and other non-pigmented finishing materials from the original shipping container to the spray gun.



Binks P-54 unit.

Known as Binks P-54 unit, it can be readily changed from one drum to another in a few seconds. The circulating pump gives results similar to those obtained with a pressure feed tank. The pump also eliminates the necessity of transferring the material from the original shipping container and makes possible an economical pressure feed system direct from the drum. Motor pump, relief valve, and fluid feed regulator are mounted on a steel base plate which may be secured to the top of drum or attached to brackets fastened to the wall above the drum.

Universal pH Indicator

Shown for the first time at the recent Chemical Exposition, a new instrument reads directly in pH with glass, quinhydrone, hydrogen or any other electrode following the Nernst equation. When used with the glass electrode system furnished, simply setting the dial of the temperature compensator adapts the entire pH scale to measurements at that temperature. This applies also if a quinhydrone electrode is substituted for the glass electrode. Equipped with a voltage scale as well as a pH scale, it is also used in oxidation-reduction potential measurements, and in current and resistance determinations. It can be used with external circuits of much higher resistance than the 100 to 300 megohms of the glass electrode which is supplied with it.

This newly-designed glass electrode is small, comparatively rugged, and requires only a 5ml sample for measurement. Everything necessary for glass electrode measurements is included with the instrument.

Other features include: quartz insulation, where necessary, to avoid leakage errors; a separate battery compartment to prevent corrosion; unimpaired accuracy in atmospheres of up to 95% relative humidity; the ability to make sodium corrections, where necessary, directly in pH units.

The Universal pH Indicator is designed to operate for years at full sensitivity and accuracy. For further information, write to Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia, Pennsylvania.

Leeds & Northrup Universal pH indicator.

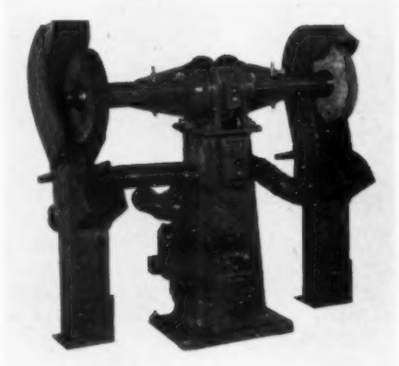
Individual Exhauster Units on Polishers

The Standard Electrical Tool Company, Evans & Eighth Streets, Cincinnati, Ohio, announce that the design of their pedestal type buffing and polishing machines in sizes from 1 to 20 HP. permits the attaching of exhauster equipment to the back of the pedestal. The same unit may be attached to any make of grinding, buffing and polishing machines.

The illustration covers the 2 HP. pedestal type buffing and polishing machine available at 1750 or 3450 RPM. The buffing motor is controlled by a magnetic starter located inside the base and connected with a push button station at front of the motor.

The exhaust blower is powered by a 3600 ball bearing motor, the motor and blower being mounted on a common base and attached to the back of the pedestal. The blower motor is controlled by a separate push button manual starter at front of the pedestal and this starter provides overload protection. If preferred the extra starter may be eliminated by having the blower motor and buffer motor connected so that the two units operate simultaneously through the magnetic starter located inside the base.

The unit is furnished complete as illustrated including the adjustable hoods and necessary piping.



Individual exhauster connected to lathe.

There is an air filtering stand available for connecting to the exhaust blower. This stand is located in back of the machine and collects all refuse while the air leaves the stand perfectly clean.

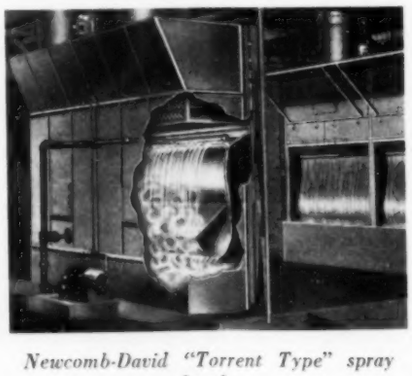
An arrangement of this kind permits the collection of dust and refuse from grinding, buffing and polishing equipment when location is remote to the regular exhausting system.

Torrent Type Spray Booth

The Newcomb-David Company, Detroit, Michigan, has recently introduced a new water type of spray booth to be known as the Newcomb-David Torrent Type Spray Booth. Because of its special construction, and by incorporating a new principle of operation, this booth is offered at a considerably lower price than the Newcomb-David booths which include water spray cleaning tubes. It is also more economical in average production use, requiring slightly less horsepower for operation.

In the Torrent Type Spray Booth, the water is drawn from the sludge tank and pumped to a horizontal pipe located near the top of the booth. The water pours in a steady volume from this pipe into a trough which deflects half of the water into the cleansing chamber at the back of the booth and the other half over the water curtain which flows behind the object being sprayed.

A positive suction fan above the booth carries the paint—and fume-laden air, and a large volume of the water which is entering the sludge tank from the water curtain, into the cleansing chamber. As the air and water are drawn up, they meet the cascade of water pouring from the pipe and trough at the top, with the result that a violent churning of air and water is developed in the chamber. Because of this churning action, the air is thoroughly cleansed before it reaches the eliminating plates in the top of the booth and the fan in the exhaust stack.



Newcomb-David "Torrent Type" spray booth.

The water curtain is essentially the same as that of the Newcomb-David Tube Type Booth. As paint is sprayed against this curtain, it is immediately carried downward to the sludge tank at the base of the spray booth. No paint accumulates on the walls or back of the booth, and that which is deposited and preserved in the sludge tank can easily be removed for reclaiming.

The principal features claimed for this booth are that, with the elimination of nozzle resistance, a much greater volume of water is pumped with less horsepower; that it is sturdy in construction and offers no possibility of paint clogging in any place where operation might be impaired.

Novel Device Collects Deadly Lead Dusts

The midget impinger, a novel air-dust collecting device developed by the Bureau of Mines, Department of the Interior, Washington, D. C., as an aid in the fight being waged against the widespread industrial menace of breathing harmful dusts, has been found to be specially efficient in the collection of the deadly lead dusts. The results of tests made to determine the efficiency of the impinger for collecting lead dusts and fumes are summarized in a report just published by the Bureau.

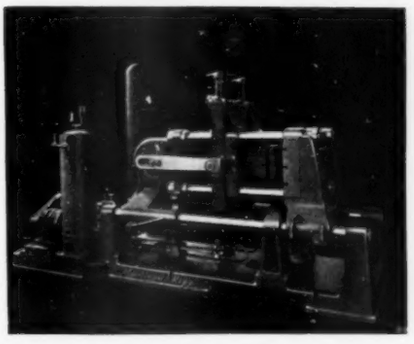
One of the recent developments of the Bureau of Mines in this field of endeavor is the midget impinger. This instrument gives results comparable to those of the large impinger for collecting pneumoconiosis-producing dusts from the air. The midget impinger is lightweight, compact, readily portable and is much more easily used than the large impinger. In the development work the midget impinger was tested against pneumoconiosis-producing dusts only, although it was known that there was possibility of wide application. Because of its many advantages, further tests have been conducted to ascertain its practicability for collecting lead dust and fume for chemical determination.

The results of these tests showed that the efficiency of the midget was essentially the same as that of the large impinger, and that each impinger had a collecting efficiency that compared favorably with that of the electric precipitator, which is the most efficient instrument available for collecting atmospheric particulate matter.

Copies of Report of Investigations 3401, "Efficiency of Impingers for Collecting Lead Dusts and Fumes," by J. B. Littlefield, Florence L. Feicht and H. H. Schrenk, may be obtained from the Bureau of Mines, Washington, D. C.

"Cold Chamber" Die Casting Machines

To provide for production of die castings made from various alloys of aluminum, magnesium, and brass, the Madison-Kipp Corporation, Madison, Wis., announces to the trade a new "400 Series" of Cold Chamber type die casting machines. These are made in three sizes. The smallest is known as the No. 400, which has a capacity for aluminum castings up to 0.9 lbs. including the casting and gate, while for brass, the capacity is 1.5 lbs. for both casting and gate, and for magnesium, 0.6 lbs. The total injection pressure on the metal in the No. 400 machine is 19,000 lbs. The intermediate size is known as the No. 440, and the large size No. 404. It should be noted that the pressures and casting weights given in this article are based on certain machine standards. In some respects the machines are flexible so that both pressures and casting weights may be varied for special requirements. The total injection pressure on the metal for the intermediate size No. 440 is 38,000 lbs. The weight of the gate and casting may be 2 lbs. in aluminum, 1.2 lbs. in magnesium, 5 lbs. in zinc, and 3 lbs. in brass. For the largest size No. 404, the total injection pressure on the metal is 63,000 lbs., and the rated capacities of gates and castings in the various alloys are 3.25 lbs. in aluminum, 2.16 lbs. in magnesium, 7.4 lbs. in zinc and from 2 to 4½ lbs. in brass. All of these machines are furnished with provision for applying ample pressure to force the molten metal into the die space by hydraulic power; and a powerful hydraulic locking mechanism holds the die closed during the casting period at the same time eliminating all strain on the die moving mechanism. The molten metal is handled in such a way that there is no danger of contaminating the alloy with iron.



Madison-Kipp "400 Series" cold chamber die casting machine.

Full details of construction and method of operation are available from the Madison Kipp Corp.

New Aluminum Casting Laboratory

The National Smelting Co., Grant Ave. near 71st St., S.E., Cleveland, Ohio, has recently installed a new experimental foundry and research department which occupies a new building of its own. Here sand and chill molds of all descriptions are poured to determine not only the best metal for any particular casting but also to observe the action of different alloys in connection with foundry problems, like gating and shrinkage.

There are various types of electrical furnaces, as well as those of the open hearth and pot types, with a forging machine fed by a furnace with automatic temperature control. A trimming room is part of the experimental foundry.

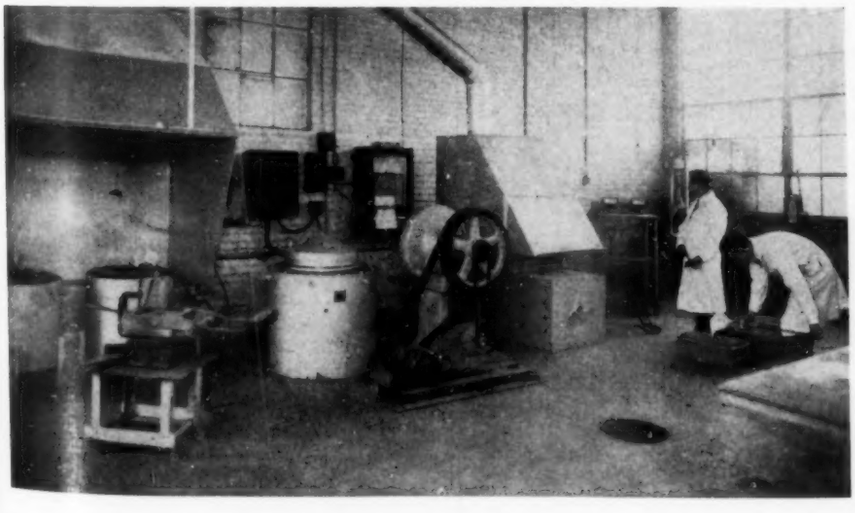
Connected with this is a machine shop where test bars are finished, and where new laboratory and smelting equipment are designed and built.

The laboratory proper consists of a large room with modern machines for testing tensile strength, fatigue, impact values, hardness and the resistance of various alloys to the corrosion of salt spray.

Then come various rooms for the exact determination of the composition and structure of various alloys. One room is devoted to spectrograph. A microphotometer is housed in another room. There are instruments to determine the electrical and thermal conductivity and the thermal expansion of alloys.

Of course, there is the usual polishing and etching department housed next to the micrographic room, and a completely equipped dark room.

The company extends a cordial invitation to all those interested in aluminum to visit these laboratories.



National Smelting laboratories. Sand and permanent mold foundry with forging machine and electric furnaces; also open hearth and pot furnaces.

Electric Metal Etcher

An electric etcher for permanently marking on metal surfaces has been announced as the latest addition to the Ideal line of electric tools, manufactured by the Ideal Commutator Dresser Company, 1941 Park Avenue, Sycamore, Illinois.

Ideal Electric metal etcher.

Used in the same manner as an ordinary lead pencil, the etcher writes, prints or marks on tools, gauges, dies and hard metal parts. The permanent lettering stands out clearly and positively, eliminating mistakes and losses, confusion and improper assembly. Two points are provided with the unit; one copper, that may be sharpened for fine marking, the other a special alloy for ordinary marking. The depth of the mark is controlled by the speed at which the point is moved over the metal, and also by changing the Hi-Lo switch on the transformer.

Lightning in a Rubber Hose

Premature failure of sandblast hose is most frequently caused by static punctures. As the tiny particles of sand or small metallic shot rush through the hose at an estimated speed of 85 miles per hour they build up thousands of volts of static electricity. This causes a spark between the lining and the cover and the hose similar to a tiny stroke of lightning which punctures the hose and sometimes knocks the operator down.

The ruinous effect of such static electricity on ordinary sandblast hose is illustrated in the attached photograph. This hose has a wall thickness of one-half inch. It is estimated that it took a charge of more than one hundred thousand volts to penetrate this thickness. Despite the fact that

the hose had been in use only a short time, this puncture necessitated its replacement.

Recently The B. F. Goodrich Company, Akron, Ohio, introduced a sandblast hose which is designed to overcome this accumulation of static. While this new hose does not eliminate static, it does provide a ground wire in the heart of the hose wall so that dischargess of static tend to ground through the wire rather than through the body of the operator. Static punctures, instead of penetrating entirely through the hose wall, reach only as far as the wire, permitting the hose to continue in service with little damage.

Sand blast hose punctured by static.

High Production Airbrush

Paasche Type BU airbrush.

A new high production airbrush called Type BU which embodies a new "snaplock" cup is a product of the Paasche Airbrush Co., 1909 Diversey Parkway, Chicago, Ill. The special features claimed for this airbrush are:

(1) Snaplock cup is fastest and easiest to handle and easiest to clean;

(2) The cup has an interchangeable cover for pint and quart cups;

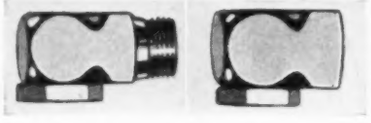
(3) The cover cannot leak after proper tightening of nut;

(4) The cup can be attached or detached in one second.

Spray Nozzles

Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill., has developed a new line of "Whirljet" non-clogging spray nozzles for various industrial and chemical processes.

The spray is of the hollow cone type with uniform distribution and a high degree of atomization. These "Whirljet" nozzles are of sturdy construction, accurately machined and are available with removal cap in male or female pipe connection, ⅛" to ¾", and one-piece construction female pipe connection 1" to 2½". Capacities range from



"Whirljet" non-clogging spray nozzles.

0.1 to 107 G. P. M. at 10 lb. pressure. All sizes are carried in stock made of brass and some sizes also in stainless steel and other durable materials.

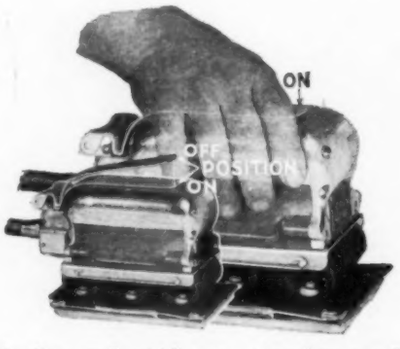
Automatic Valve Control

Thousands of cubic feet of air are wasted daily in plants throughout the country because operators of pneumatic tools neglect to stop their machines while changing operations.

The Sterling Products Company, 2457 Woodward Ave., Detroit, Mich., manufacturers of the Sterling Speed-Bloc Sander, have developed a new automatic valve control. This device automatically starts and stops the sander and controls the flow of water when hose is attached for wet sanding.

Low air consumption is one of the outstanding features claimed by the manufacturers of the Sterling Sander. The use of bar stock, aluminum pistons and expander rings mounted behind piston cups in the latest model, reduced air consumption to approximately 5½ cubic feet per minute under full load at speeds of 3000 oscillations per minute.

The control is designed to fit all model Sterling Sanders and is quickly installed by simply removing the hand-operated air and water cams, using the same holes that held the cams to install the automatic control.

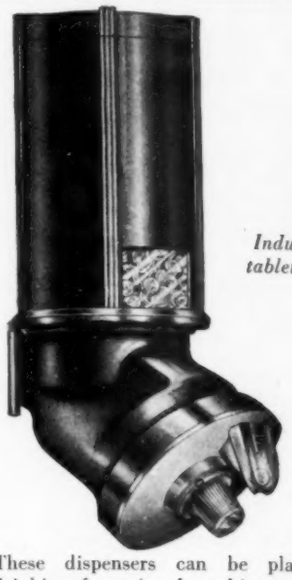


Sterling sander with automatic valve control.

Descriptive literature will be forwarded upon receipt of request for Circular No. 1045.

Salt Tablet Dispensers

Industrial Products Co., 800 W. Somerset St., Philadelphia, Pa., has placed on the market a new dispenser for salt or sodium chloride tablets to be installed in factories.



Industrial salt tablet dispenser.

These dispensers can be placed beside drinking fountains for taking a tablet with a swallow of water. It is especially useful during the hot weather when perspiration, which results in loss of salt, causes muscular fatigue. A total of 4 to 6 tablets during a work period is effective to maintain the proper salt balance in the body.

The dispenser has a capacity of 1500 tablets.

Wrinkle Finishes in All Colors

A new line of wrinkle enamels, which greatly extends the usefulness of this popular type of finish, has been developed by Maas and Waldstein Company, makers of industrial finishes, 428 Riverside Ave., Newark, N. J.

Heretofore, wrinkle finishes have been available only in the darker colors, but Duart Wrinkle Enamels, as the new M&W line is called, can be supplied in every color, including white and light pastel shades. Practically no discoloration occurs during the baking process.

Another improvement claimed by the manufacturer is that Duart Wrinkle Enamel bakes hard and wear-resistant with a short baking schedule, whereas the older enamels remained rather soft unless baked at high temperatures for a long time. Uniform wrinkling, without glossy spots, "shiners," or "fish eyes," is also claimed for the new product.

The product is light in body and can be sprayed like synthetic enamel, giving a high coverage per gallon. The patterns can be varied from a very fine and uniform to a very coarse and heavy structure. One coat is all that is needed.

Duart Wrinkle Enamels are manufactured under license from New Wrinkle, Inc.

NICKEL IN GENERAL ELECTRIC BRONZE CASTINGS

. . . promotes pressure-tightness!

Nickel bronze casting for oil-cooled General Electric transformer. One and a half per cent of Nickel added to regular 85-5-5-5 mixture helped to obtain oil-tightness.

NUMEROUS bronze castings are employed in the construction of G-E transformers, which, in order to prevent liquid seepage, are required to withstand a hydrostatic pressure test. Encountering some difficulty in meeting this specification with standard red bronze commonly in use for pressure castings, the General Electric Foundry at Pittsfield, Mass. decided to look into the question of Nickel additions to their mixtures.

To the regular 85-5-5-5 bronze mixture 1½% Nickel was added. Result: Increased density and improved quality of G-E castings for oil-cooled transformers. In one run of 120 castings, every one was oil tight after all machining operations had been completed.

Add a small percentage of Nickel to your bronze compositions and you increase pressure tightness. Add Nickel to such common mixtures as tin bronze and red brass, too, and you get these *additional* improvements: Increased strength and toughness, and a fluidizing effect that facilitates casting operations and reduces misruns. Consultation on casting problems involving the use of Nickel is invited. Address:

NICKEL BRASS & BRONZE

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

INTERESTING DISCOVERIES THAT LED TO IMPORTANT PRODUCTION SAVINGS

3 BRASS DRAWINGS

THE PROBLEM

To draw pieces of brass tube, elongating them from 4″ to 7″ without rejects.

THE ANSWER

Drawing these with the help of MAGNUS DRAWING LUBRICANT, all trouble and difficulties eliminated.

The above actual photograph shows the simple four steps of this brass drawing operation easily accomplished with the use of MAGNUS DRAWING LUBRICANT.

NO REJECTS

The material previously used "ground up" the machine and was very hard to wash off the parts.

MAGNUS DRAWING LUBRICANT flows evenly over the entire surface of the finish with plenty of adherence. No rejects. Punch no hotter. Solution rinses more easily.

RINSES MORE EASILY

Let us show you how MAGNUS DRAWING LUBRICANT and other MAGNUS Metal Lubricants will cut your costs, give you better work—and materially increase your profits in other ways as well.

Write today for a nearby MAGNUS SERVICE REPRESENTATIVE to demonstrate to you under your own plant conditions. Or, send us the details of your operations for our specific recommendations.

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

11 South Avenue Garwood, N. J.

MAGNUS CLEANERS

A Definition of Metal Spray

By **A. V. GRUBER**

Condenser Service & Engineering Co., Hoboken, N. J.

The process consists of a unit which entails oxy-acetylene or oxy-hydrogen or other combustible gases flame; or a unit constructed to use an electric arc process, and compressed air or inert gas, an air turbine or electric motor or a Venturi System. The air turbine or electric motor unit drives a train of gears used to feed the material in wire form to be sprayed into the oxy-acetylene, oxy-hydrogen or other combustible gases flame (or to feed two wires together at a continuous rate, sufficient to produce an arc in the electric arc system which melts the wire) where it is melted and atomized and blown onto the surface which is to be built up or sprayed. The Venturi system uses the material in powder form and conducts it by means of compressed air, inert gases, or combustible gases into the oxy-acetylene or oxy-hydrogen or other combustible gases flame and blows it on the surface which is to be built up or sprayed.

In order to be proficient in metal spraying, the operator must have a thorough knowledge of the flame characteristics of combustible gases, compressed gases and air, and proper surface preparations of the surfaces or areas to be sprayed with molten metals.

The surface preparation consists of a premachining and/or sandblasting operation, or the use of a roughening or abrading tool. The nature of surface preparation by sandblasting for metal spray to obtain maximum adherence of the sprayed metal to the surface, is peculiar in itself, and is not to be confused with ordinary type of sandblasting for merely cleaning or preparation for painting.

The finishing of sprayed metal surfaces also differs from ordinary machine shop practice in that special tools and grinding wheels must be used with the various types of metals and finished at certain rates of speeds, feeds and cuts.

The process is successfully used for building up worn or new mechanical, rotating, sliding or reciprocating equipment, for protecting surfaces with the more noble metals to resist acid, alkali, gas, heat and other corrosion or abrasion, for effecting decorative surfaces on practically any type of material such as steel, wood, paper, cloth, glass, plaster-paris and others, and for producing electrical conducting surfaces on dielectric materials.

To become expert at metal spraying the operator must start from the ground up and become thoroughly familiar and master each phase of the work.

The time and tests required to become a first-rate metal sprayer are of necessity rigid, since the success of this process depends entirely on the skill of the operators.

It is important to know the limitations of metal spray. It is not a cure for all evils.

Manufacturers' Literature

"*Neoprene Notebook.*" Information for the engineer on the properties of this material. E. I. duPont de Nemours & Co., Wilmington, Dela.

Mill Duty Safety Switch; window type. Bulletin No. 4101. "Current Breaker." Cutler-Hammer, Inc., 12th & St. Paul Ave., Milwaukee, Wisc.

Neutral Wedge Photometer. An abrasive instrument for photometric determination in any reaction where a definite and reproducible color is obtained. American Instrument Co., 8010 Georgia Ave., Silver Springs, Md.

Solid Bronze Hardware; for residence casements. Mesker Bros. Iron Co., St. Louis, Mo.

Wappat Red Streak Drill. Portable drills; four styles; also bench grinders, electric hand saws, etc. Wappat Inc., Pittsburgh, Pa.

"1838 to 1938." The Golden Anniversary of Robert W. Hunt Company, inspection engineers, 2200 Insurance Exchange, Chicago, Ill.

Industrial Compressors and Vacuum Pumps. Type 30 line, ranging from ¼ to 15 horsepower. Bulletin No. 2118. Ingersoll-Rand Co., 11 Broadway, New York.

Back-Geared, Screw-Cutting, Metal Working Precision Lathes. General Catalog No. 97. South Bend Lathe Works, South Bend, Ind.

The Housing Program Vs. Rent and Population Trends, by Allen W. Rucker and N. W. Pickering, President, Farrel-Birmingham Co. Inc., Ansonia, Conn.

Quality Hose; for spray painting, welding, pneumatic tools; water; for air or liquids. The DeVilbiss Co., Toledo, Ohio.

Standard Towers and Accessories. Bulletin C-1, describing all types of reaction, absorption, fractionating towers made of Haveg. Haveg Corp., Newark, Dela.

Corrosion and Leak Proof Tanks and Towers. Pyroflex and Knightware slab construction. Bulletin No. 712. Maurice A. Knight, Kelly Ave., Akron, Ohio.

"When You Can Measure." Contributions of the General Electric engineers and scientists to the important art measurement. General Electric Co., Schenectady, N. Y.

Multirange Arc Welders. "1000 combinations." Hobart Bros., Hobart Sq., Troy, Ohio.

Modern Analysis; equipment for spectrographic analysis and also for the rapid and accurate determination of carbon and sulphur. Harry W. Dietert Co., 9330 Roselawn Ave., Detroit, Mich.

Commutation Factor; No. 1 of a series of bulletins on brushes and commutation. *Measurement of the Frictional Characteristics of Brushes* by Dr. S. W. Glass, No. 2 of this series; *Brush Angle,* No. 3; *The Theory of Commutation,* No. 4. Published in Modern Pyramids, put out by the National Carbon Co. Inc., 30 E. 42nd St., New York.

Grinding Chrome Alloys; a new tool. The Dumore Co., Racine, Wisc.

"A Trip Through Plant." Pictorial presentation of the plant of the Monarch Machine Tool Co., Sidney, Ohio.

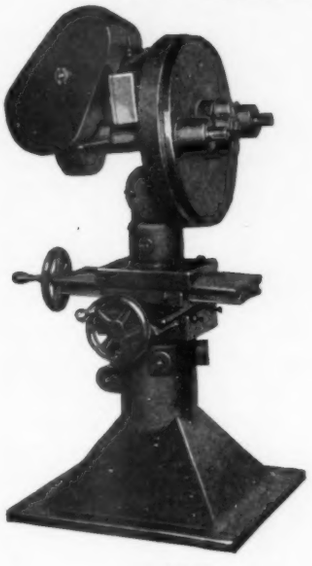
Filter Presses and Diaphragm Pumps. Instruction manual on selection and proper operation of filtration equipment. Catalog 38. T. Shriver Co., 819 Hamilton St., Harrison, N. J.

ACME AUTOMATIC

TYPE "A-2"

POLISHING—BUFFING MACHINE!!

SEE ACME FOR PRACTICAL POLISHING AND BUFFING MACHINE ARRANGEMENTS



SPECIAL MACHINERY — AUTOMATIC BUFFING MACHINES

A two-spindle hand indexing machine used in conjunction with the standard lathe for polishing and buffing various cylindrical shaped parts, such as hub caps, clock cases, covers, small head light bodies and doors, plumbers' brass goods, parts of electrical fixtures, hardware, etc.

When the machine is set up and adjusted to the lathe, the work on one spindle is contacting the polishing or buffing wheel and being finished, while the operator is unloading and loading the opposite spindle. The head is indexed and the operation repeated. In this manner work is contacting the wheel practically continuously at a maximum and uniform pressure. Production is increased several hundred per cent.

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Norblo Screen Type Dust Arrestor. Bulletin 100-2. Northern Blower Co., 6409 Barberton Ave., Cleveland, Ohio.

Tiering Fork Truck; capacities from 3500 to 5000 pounds. Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio.

High Lift Platform Trucks; capacity 4000 pounds. Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio.

Cadalyte "38"; for modern cadmium plating. A technical service manual. E. I. duPont deNemours & Co. Inc., Electroplating Division, Wilmington, Dela.

V-Belts; "Condor Whipcord." Bulletin 6868, giving technical details of the functions and construction of the V-belt. Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

Automatic Buffing Machine; describing a new principle in high speed buffing. Shakespeare Products Co., Kalamazoo, Mich.

"Carrying on a Tradition"; a booklet containing a history of the company and photographs of officers and staff. Handy & Harman, 82 Fulton St., New York City.

Chromium Chemicals as Corrosion Inhibitors. Brief summaries of studies and experience in the use of chromium chemicals for the purpose of inhibiting corrosion. Mutual Chemical Co. of America, 270 Madison Ave., N. Y.

Corrosion Resistant Chemical Equipment; General Bulletin 0-1. Haveg 41 for general use and Haveg 43 for resistance to hydrofluoric acid. Haveg Corp., Newark, Dela.

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Nickel Brasses and Bronzes. Descriptions of typical applications with some details of recommended production procedure. International Nickel Co. Inc., 67 Wall St., New York.

Dust Collecting. Descriptions and illustrations of installations in large manufacturing plants, foundries, polishing and buffing departments, etc. The book is attractively illustrated and includes an imposing list of plants in which such installations have been made by the Kirk & Blum Manufacturing Co., Cincinnati, Ohio.

Skimmers. "Pyramid"; for assurance against contamination; high heat resisting alloys. Foundry Division, Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill.

Sand Conditioning; "Sandcutter method"; Catalogs No. 15 and 20. American Foundry Equipment Co., 408 S. Byrkit St., Mishawaka, Ind.

"Super-Duty Brick for Super-Duty Service." "Alamo" and "Varnon" refractories. Harbison-Walker Refractories Co., Pittsburgh, Pa.

Intensive Mixer; 9 sizes of Simpson intensive mixer; also complete auxiliary equipment for sand reclamation, conditioning, control and handling equipment. Published on the twenty-fifth anniversary of the company. National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

Method for Tempering; "Homo"; catalog T-625; varieties of work now being tempered, annealed or normalized in modern Homo furnaces. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

Core Wire Straigthening Rolls, Bulletin 58A. Kane & Roach, Syracuse, N. Y.

Stiffness Gauge; Tabor V-5; precise standard measurements of stiffness and resilient qualities of materials. Tabor Instrument Co., North Tonawanda, N. Y.

Millivoltmeter Pyrometers; complete line including indicator controllers with enclosed mercury contacts or solid metal-to-metal contacts; single point indicators and multiple-point indicators with rotary switch. Bristol Co., Waterbury, Conn.

Titrimeter; instrument for more accurate volumetric analyses, employing the latest electronic circuits in acting as a universal chemical indicator. Fisher Scientific Co., 711-23 Forbes St., Pittsburgh, Pa.

Gas Conditioning Units; Catalog No. 380; bright annealing furnace using furnace gases for protective atmosphere, etc. W. S. Rockwell Co., 50 Church St., N. Y.

"How to Cut Crucible Costs." Suggestions for the storing, handling and use of crucibles. Crucible Manufacturers Assoc., 90 West St., N. Y.

pH Indicator; portable universal pH indicator for laboratory and plant; direct reading with glass, hydrogen and quinhydrone electrodes. Leeds & Northrup Co., 4902 Stenton Ave., Philadelphia, Pa.

Gears and Gear Units. Catalog 438 "Farrel-Sykes." Farrel-Birmingham Co., Inc., Ansonia, Conn.

Abrasive Bond; for setting up polishing wheels and belts. "Nuglu." J. J. Siefen Co., 1936 W. Lafayette Blvd., Detroit, Mich.

Portable Electric Drills. "Mall Red Streak," ¼" heavy duty, ⅜" heavy duty, ¼" standard duty, ⅜" standard duty drills, etc. Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill.

"How Feasible is an Annual Wage for Labor?" Discussed by A. W. Rucker and N. W. Pickering, President, Farrel-Birmingham Co., Ansonia, Conn.

Heat Exchangers. Bulletin No. 1601-A; for corrosive liquids, such as pickling and plating solutions. The Duriron Co. Inc., Dayton, Ohio.

"How to Fit Eye-Protection Goggles to Workers for Greatest Comfort and Safety." American Opical Co., Southbridge, Mass.

Colored Aluminum Powder; Aluminum Sparkle "Rip-pl," low bake (oil type). Bulletin No. 15 S. A. First edition. Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.

"The Story of Interrelated Research." Recent developments in printing, industrial color finishing, textile coloring and other industries. Interchemical Corp., 75 Varick St., N. Y.

Termite Protection with Copper Shields. A handbook for architects and sheet metal workers. Copper and Brass Research Association, 420 Lexington Ave., New York.

Chemical Cartridge Respirators: for protection against vapors encountered in spraying operations; also against light concentrations of organic and acid gases occurring singly or in combinations. Mines Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

Endless Belts; bulletin 6869; Condor Whipcord Endless Belt. Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Mechanical Rubber Goods, Passaic, N. J.

Modern Finishes for Metal Articles: Brunofix, Niklit, Oxydalin, Meprol, Degres, etc. Metal Processes, Ltd., 48 Frederick St., Birmingham 1, England.

Chemicals, Processes, Materials, Service for Electroplating. The complete group of duPont chemicals, processes and materials of interest to those engaged in electroplating. E. I. duPont de Nemours & Co. Inc., Electroplating Div., Wilmington, Dela.

Spring Machinery. Advantages and features of "Segment" and "Clutch" Type spring coiling machines. The Torrington Manufacturering Co., Torrington, Conn.

Watch for the Coming Issues of METAL INDUSTRY!

Convention issues are over until the Fall, but special articles continue. We have on schedule:

Cost Reduction in the Plating Department, by C. F. Scribner, Management Consultant.

The Physical Properties and Uses of Heavy Nickel Deposits, by Dr. W. A. Wesley, International Nickel Co., Inc., N. Y.

Getting the Most Out of Your Lacquer, by W. T. Smith, Chemist.

The Cost of Electroplating Nickel, by Joseph Haas.

Watch for the Coming Issues of METAL INDUSTRY!

What the Reader Says

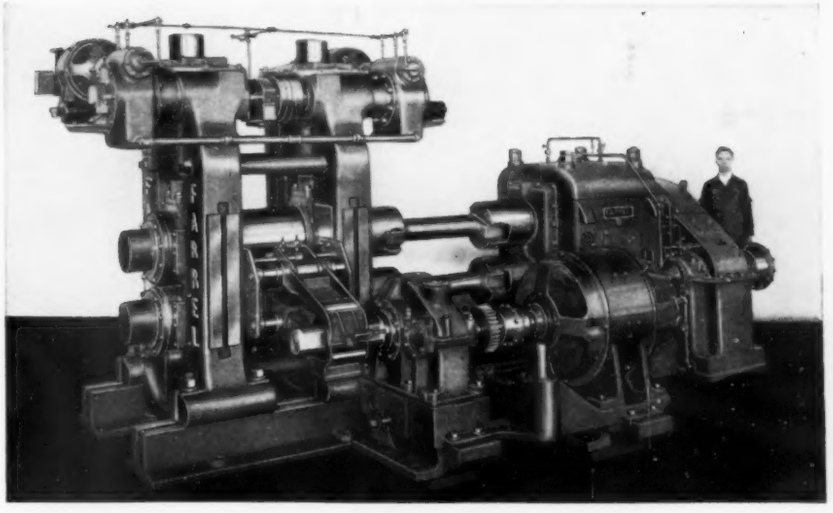
Electrodeposition From Non-Aqueous Solutions

Editor, METAL INDUSTRY

In your June 1938 issue, just received, an article (page 284) on electrodeposition of metals from non-aqueous solutions fails to mention work done along this line by other electro-chemists, particularly depositions of caesium upon nickel, tantalum and other metals. The solution usually consists of benzol and glacial acetic acid.

The process which employs a series of tubular anodes of tungsten or of rhodium plated copper and through which hydrogen is emitted into the bath, has been in commercial use for about ten years in the manufacture of photo-cells for wide-range sound picture projection. This process is patented by Leslie L. Linick, U. S. No. 1,777,121 and subsequent applications.

Chicago, Ill. S. J. BARTLETT
Linick, Green & Reed, Inc.



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The material is blocked on solid blocks at constant tension and is wrapped by means of a jaw type wrapper. Full blocks are stripped by an air-operated stripper.

The reduction gear drive and pinion stand are combined in an integral unit, with Sykes continuous tooth herringbone gears and pinions mounted in anti-friction roller bearings. Built-in oil pump provides spray lubrication of the gear teeth and flood lubrication of the bearings.

This mill is typical of the modern design features built into Farrel Rolling Mills which permit high speed operation, increase output, improve quality and reduce production costs.

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Our brief paper did not make any attempt to review completely all the work that has been done on the electrodeposition of metals. Such a review would have included many more references to the literature than we thought advisable in so short an article. We did not, for example, mention the very important work along this line which has been done at our laboratories by Dr. Mathers and his students. Our paper was intended to describe very briefly our experiments in certain non-aqueous solutions. We have not dealt with mixtures of such solvents.

I find Mr. Bartlett's letter very interesting, and I am glad particularly to note his mention of commercial applications of this kind of work. H. T. BRISCOE

Bloomington, Ind. Indiana University

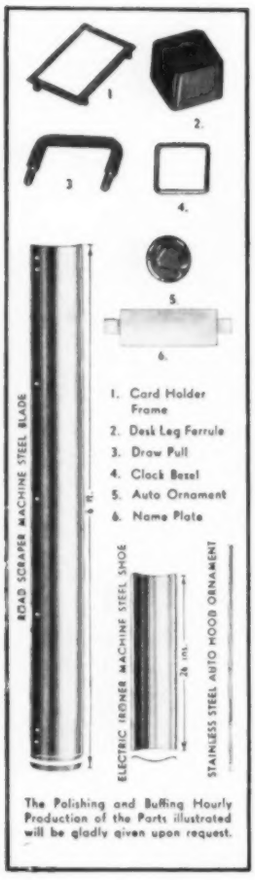
Soldering Antimonial Lead

Editor METAL INDUSTRY:

One of our astute men noticed your article on "Soldering Antimonial Lead", designated as problem 5,652, in the April, 1938 issue of METAL INDUSTRY.

We wish to draw to your attention the fact that the best authority we know of, places the eutectic mixture of lead and tin at 62% tin and 38% lead with a melting point of 360° F. This solder might well be used when making joints on antimonial lead containing 13% antimony, because the latter alloy has a melting point of 477° F.

In some cases, an alloy with a still lower melting point is desired for soldering tin, pewter, or antimonial lead, and then the



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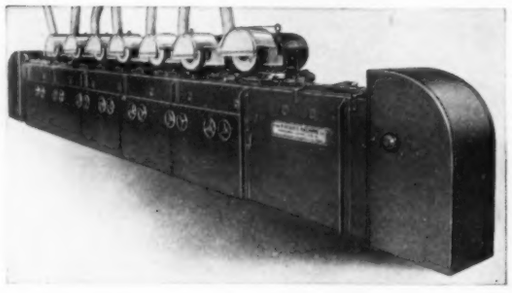

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ternary eutectic of tin, lead and cadmium might well be used. It is composed o' 49.8% tin, 18.2% cadmium and 32% lead. Its melting point is 293° F.

We are in agreement with your remarks regarding fluxes and in addition might suggest that the parts of antimonial lead to be soldered might be scraped clean in order to make the mild fluxes more effective.

The Metals Handbook is a valuable reference in regard to many of the lead, tin and antimony alloys.

Brooklyn, N. Y.

NATIONAL LEAD COMPANY
George O. Hiers

Technical Publications

Modern Plating of Die Castings. Modern methods of cleaning and electroplating zinc alloy die castings are interestingly described in a 4-page feature article appearing in the May-June issue of Oakite News Service, a magazine published by Oakite Products, Inc., 14 Thames St., New York, N. Y., manufacturers of cleaning materials for the metal working industry.

Practical formulas for plating die castings with copper, nickel, chromium, or cadmium deposits are fully outlined. A brief explanation of a recently developed and patented process for thoroughly removing grease and dirt from articles prior to the alkaline bath is also given. Copies of this article are available upon request.

Indium: Occurrence, Recovery and Uses, by R. E. Lawrence and L. R. Westbrook, Grasselli Chemicals Dept., E. I. duPont de Nemours & Company, Inc., Cleveland, Ohio. Industrial and Engineering Chemistry, June 1938, pages 611-14.

This paper is essentially a review of the available literature on the subject, summarized on the basis of the authors' work on analysis and separation of the element from process residues.

The history and occurrence of the element are dealt with briefly. The physical and chemical properties are compiled from a survey of the literature with careful selection of the most accurate values based on the latest information available. The various quantitative and qualitative schemes mentioned in the literature are reviewed briefly, and the procedures used by the authors are outlined. The process developed by the authors for the recovery of indium in the form of pure metal from process residues from zinc operations is described, and references to processes used by others are given. Proposed uses for indium are reviewed, including a number of recently patented applications.

Film Continuity of Synthetic Resin Coatings. Effect of Composition and Molecular Weight on Minimum Coating Weights for Thermoplastic Resin Films. By G. H. Young, G. W. Gerhardt, W. K. Schneider and G. W. Seagren, Mellon Institute, Pittsburgh, Pa. Industrial and Engineering Chemistry, June, 1938, pages 685-688.

Minimum coating weight studies on eight experimental thermoplastic vinyl resins of varying compositions and of varying molecular weights show that the coating weight required to just produce complete film continuity varies directly with the vinyl acetate content and inversely with the average molecular weight. This observation seems to be in complete agreement with a tentative theory involving partial orientation conditioned by the activity of the metal being coated and by the effective polarity of the thermoplastic resin.

Heat Transfer of Porcelain Enamel Metals and Other Materials, by J. C. Bell. Published by the Technical Staff of the Ferro Enamel Corp., Cleveland, Ohio.

Magnetic Methods for Measuring the Thickness of Nonmagnetic Coatings on Iron and Steel, by Abner-Brenner. Research Paper RP1081. National Bureau of Standards, Washington, D. C.

Reference Tables for Iron-Constantan and Copper-Constantan Thermocouples, by Wm. F. Roeser and Andrew I. Dahl. Research Paper RP1080. National Bureau of Standards, Washington, D. C.

The Coating of Metals with Tin from the Vapour Phase ("*Stannising*"), by B. W. Gonser and E. E. Slowter. Series A. No. 76. Technical Publications of the International Tin Research and Development Council, 149 Broadway, New York.

Some Factors that May Determine the Service Life of Tin-Base Bearing Metals, by D. J. McNaughtan. Series A. No. 75. Technical Publications of the International Tin Research and Development Council, 149 Broadway, New York.

Second General Report 1937. International Tin Research and Development Council, 149 Broadway, New York.

Government Publications

Platinum and Allied Metals in 1937—Advance Summary. Bureau of Mines, Washington, D. C.

Copper Industry in 1937—Advance Summary. Bureau of Mines, Washington, D. C.

Newark Branch, A.E.S.

Secretary, George Wagner, 1130 S. Long Ave., Hillside, N. J.

The Newark Branch of the American Electro-Platers' Society will hold its Annual Picnic on Saturday, July 23rd, at Galloping Hill Grove, Union, N. J. There will be games for the ladies and games for the men and prizes for the winners.

Refreshments from 12 noon until 9 P.M.; clam chowder, clams, "hot dogs," hamburgers, beer and soda; all anyone wants, anytime they want it and as often as they want it. Tickets for adults $1.75 each; tickets for children $1.00 each.

Reservations must be made no later than Wednesday, July 20. Send in reservations to George Wagner, secretary, business address, 35 Fourth St., Newark, N. J.

Bring friends; a good time is in store for all. "Newark Knows How."

Personals

Dr. Alan Morris

Dr. Alan Morris, formerly Research Engineer, has been promoted to the position of Chief Metallurgist of the Bridgeport Brass Company, Bridgeport, Conn. He will be in charge of the Physical and Chemical Laboratories as well as research activities.

Dr. Morris has had many years of experience in non-ferrous metallurgy having been actively engaged in the laboratory and mills developing new and better alloys and improving the standard ones. He has been with the company since 1923.

Dr. ALAN MORRIS

Both his Bachelor of Science and his Metallurgical Engineering Degrees were received from Columbia University. He was recently awarded a Doctor of Engineering Degree by Yale University where he studied metallography under Dr. C. H. Mathewson, an eminent authority on non-ferrous metals. He is a member of the A.I.M.E., the A.S.M. and the British Institute of Metals.

Harry M. St. John

Harry M. St. John, for many years chief metallurgist of the Detroit Lubricator Co., Detroit, Mich., and associate editor of METAL INDUSTRY, has taken charge of the non-ferrous foundry of the Crane Co., Chicago, Ill. He will continue to act as metallurgical editor of this journal.

Mr. St. John was born November 29, 1888, in Canajoharie, N. Y. He graduated from Cornell University in 1910. His first

H. M. ST. JOHN

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job was as research chemist for the National Carbon Co., Cleveland, where he remained until 1913 when he became research engineer of the Commonwealth Edison Co., in Chicago. Five years later he entered the Chemical Warfare Service of the U. S. Army and served as captain, engaging in the manufacture of Lewisite at Willoughby, Ohio.

After the war Mr. St. John was manager of the Detroit Electric Furnace Co., Detroit, from 1919 to 1923. From 1923 to the present he has been chief metallurgist of the Detroit Lubricator Company.

Mr. St. John has always been very prominent in the work of the technical societies in the metallurgical field. He is a member of the American Institute of Mining & Metallurgical Engineers (Chairman of the Detroit section). He is a past chairman of the Non-Ferrous Division of the American Foundrymen's Association. He is a past president of the Electrothermic Division of the Electrochemical Society. He is also a member of the American Chemical Society, American Society for Metals, American Society for Testing Materials and Engineering Society of Detroit. He has served on numerous committees for the above societies and is the author of a large number of technical papers on electric furnaces and non-ferrous metallurgy.

Dr. Wesley P. Sykes

Dr. Wesley P. Sykes, metallurgical engineer at the Cleveland Wire Works of the General Electric Company was recently awarded

Dr. W. P. SYKES

the honorary degree of Doctor of Engineering at the commencement exercises of Case School of Applied Science, Cleveland. Dr. Sykes entered the General Electric Co., after the war, where he became interested in the study of the operations and production of pure tungsten and molybdenum metals in wire form. The development of new alloys containing these two metals has comprised the major part of his work and he has published many technical papers on the subject of metals. He is considered an outstanding authority and his writings have been translated into 17 foreign languages.

Dr. R. F. Mehl

Dr. Robert F. Mehl, head of the Department of Metallurgy and director of the Metals Research Laboratory at the Carnegie Institute of Technology, was awarded the honorary degree of Doctor of Science by Franklin and Marshall College at the annual commencement exercises.

The degree was presented with the following citation: "A graduate of Franklin and Marshall College with the degree of Bachelor of Science and of Princeton Uni-

Dr. R. F. MEHL

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versity with the degree of Doctor of Philosophy, since 1923 associated, in order, with Juniata College, Harvard University, the Naval Research Laboratory, the American Rolling Mill Company, and the Carnegie Institute of Technology, in which at present he is professor and Director of Research in the Department of Metallurgy, Dr. Mehl has made extensive contributions of great practical value to the science of Physical Chemistry. By his many successful investigations into the physical and chemical properties and behavior of metals and alloys, and especially by his invention and development of gamma-ray radiography, he has rendered extraordinary service to American industrial enterprise and American naval engineering."

George D. Hartley, consultant, 311 Main St., Worcester, Mass., has opened an office at the above address, for handling work relating to mechanical and industrial problems including: inventions and patents, experimental and development work, designing and building equipment and machines, machine manufacturing—production methods—factory equipment, management and personnel problems, sales—domestic and foreign, marketing new processes, inventions and patents—domestic and foreign. *Mr. Hartley* was one of the organizers of *Sleeper & Hartley*, Worcester, Mass.

Nelson W. Pickering, president Farrel-Birmingham, Inc., Ansonia, Conn., was elected president of the National Metal Trades Association at the 40th annual convention, held May 25-26, at the Hotel Biltmore, New York.

D. W. Pritchard has been transferred to the Chicago area by the Pennsylvania Salt Mfg. Co., Philadelphia, where he is introducing a new line of heavy duty cleaners.

C. Donald Dallas, President Revere Copper and Brass, Inc., New York, is the author of a new book entitled, "You and Your Money", Published by Braunworth & Co. Inc., Bridgeport, Conn. This book gives Mr. Dallas' thoughts about the problems and prospects of prosperity and progress in America for the inspiration and instruction of the young Americans of his time. Interesting features of this book are comparisons of capitalism and communism, a discussion of investments, real estate, taxes and the struggle for security. A foreword has been written by *Virgil Jordan*, President of the National Industrial Conference Board.

Obituaries

Richard C. Lewis

Richard C. Lewis, 42, sales engineer of Farrel-Birmingham Company, Inc., Ansonia, Conn., was killed in the accident to the United Airlines plane which crashed at 10:20 p. m., May 24, 1938, just before reaching its destination, the Cleveland airport.

At the time of his death Mr. Lewis was manager of the rolling mill sales division of the Farrel-Birmingham Company in charge of sales of rolling mill equipment and roll grinding machines. He was widely

RICHARD C. LEWIS

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known throughout the rolling mill industries as an experienced and capable engineer with a thorough knowledge of the design and operation of rolling mill equipment. He was highly esteemed for his personal qualities as well as for his professional ability by all of his associates and his many friends in the trade, and his passing is deeply regretted.

L. J. Tavenor

L. J. Tavenor, American representative of the International Tin Research and Development Council, died on May 29th at the Orange Memorial Hospital, East Orange, N. J.

Mr. Tavenor was born in Auburn, N. Y., March 9, 1892. He worked a while with the Riggs National Bank in Washington, D. C. He was secretary to Col. Milton A. McRae who is founder of Scripps-McRae League of Newspapers. Mr. Tavenor joined the International Tin & Development Research Council, 149 Broadway, New York, six years ago. He leaves a wife, a daughter and a son.

Gavin J. Tyndall

Gavin J. Tyndall, Vice President, Secretary, and Director of the Geo. L. Claflin Company, died May 25, 1938, in the Massachusetts General Hospital after a short illness.

He was born in Hyde Park, Vermont, on October 25, 1880, the son of John and Mary Tyndall and obtained his early schooling at the People's Academy, Morrisville, Vermont. Later he attended Albany Business College at Albany, New York, and while there worked for the New York Central R. R. Company in the train dispatcher's department. After a period of several years he moved to Schenectady, New York, where he worked for the General Electric Company, leaving them to take up his residence at Attleboro, Massachusetts, where he was living at the time of his death.

Shortly after coming to Attleboro he was employed by the A. S. Ingraham Company, leaving them in the fall of 1910 to assume management of the Attleboro Industrial Branch of the Geo. L. Claflin Company. He was successively Manager of the Branch, Assistant Secretary, Secretary, and finally Vice President, Secretary, and Director during the last ten years. He was also an official in the affiliated companies.

GAVIN J. TYNDALL

He was married August 21, 1914, to Olive Hinds of Attleboro who, with one son, Bradford E. Tyndall, survive him. He is also survived by his father, John Tyndall, four sisters, the Misses Grace and Winifred Tyndall of Morrisville, Vermont, Mrs. Kathryn Moore of Rochester, New York, and Mrs. Nellie Goodrich of Hanover, New Hampshire, and by three brothers, John N. Tyndall of Attleboro, Massachusetts, James Tyndall of Bellingham, Massachusetts, and Karl Tyndall of Morrisville, Vermont.

Mr. Tyndall was a member of the Attleboro Chamber of Commerce and a Director of the Attleboro Y. M. C. A. for many years. He had also served on various Attleboro Community Committees. He was a Registered Pharmacist in Rhode Island, a member of the R. I. Pharmaceutical Association, the R. I. Traveling Men's Auxiliary, the American Electro-Platers Society (Providence-Attleboro Branch) and the Corporation of the R. I. College of Pharmacy and Allied Sciences. He served six years on the Merchandising Committee of the Druggists' Supply Corporation of New York, a national organization of which his firm was a member, and at the time of his death had been

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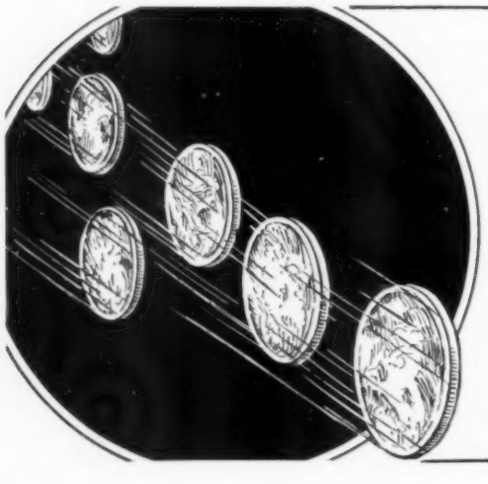


PERMAG *Scientific Cleaning Compounds*

helps start PROFITS rolling Your Way

PERMAG Cleaning Compounds keep cleaning costs down. Does a cleaning job 100 per cent.
Eliminates metal cleaning troubles in the finishing department. A new development in achieving fine results as an all-around metal cleaning compound, including cleaning before plating. Many repeat orders attest its service and emciency. Call on Magnuson experts for help in metal cleaning problems. Write or 'phone.

MAGNUSON PRODUCTS CORPORATION

Third and Hoyt Streets, Brooklyn, N. Y.

Mfr's of Specialized Scientific Cleaning Compounds for Every Industrial Purpose
Warehouses in Principal Cities of U. S. Representatives from Coast to Coast
Canadian Branch: Canadian Permag Products Ltd., Ottawa & Queen Sts. Montreal, P. Q. Cable Address PERMAG, N. Y.

Secretary of the New England Drug Exchange for many years.

The funeral was held from Stone's Funeral Home, 44 Dean Street, Attleboro, Massachusetts, on Saturday, May 28, 1938, at 2 o'clock and interment was at Attleboro, Massachusetts, North Purchase Cemetery.

Verified Business Items

J. Holland & Sons, Inc., polishing and electroplating equipment have moved into their own building at 274-278 South 9th St., at Broadway, Brooklyn, N. Y.; 4 stories, giving about 30,000 additional sq. ft., which will contain offices, showrooms and factory. The firm will maintain its present warehouses at 25-47 Johnson Avenue.

Detroit Rex Products Co., Detroit, Mich., has recently opened a new branch office at 111 Sutter Bldg., San Francisco, Calif., in charge of *W. A. Vensel*, West Coast manager.

Magnus Chemical Co. Inc., Garwood, N. J., announces three appointments as follows: *Carl Geyer* as sales representative in Ohio and West Virginia; *Ralph Neely* becomes a resident sales representative in Calif; *Carl Steinberg* will represent Magnus in sections of Penna.

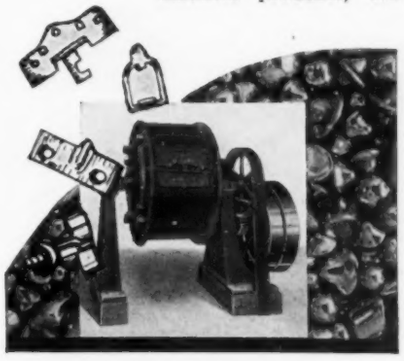
A. J. Wadhams, vice-president and manager of the Development and Research Div., *International Nickel Co., Inc.*, 67 Wall St., N. Y., has announced the establishment of a new field office located in Grant Bldg., Pittsburgh, Pa., under the direction of *H. V. Beasley*, who for the past three years has been attached to the N. Y. office. The main function of this office will be to promote applications of nickel alloy steels and products of the Huntington Mill and stimulate interest in nickel cast irons and the use of nickel in non-ferrous alloys. This is the fifth field office opened by the Development and Research Div. Other offices are located in Los Angeles, Cal., Chicago, Ill., Detroit, Mich., and Hartford, Conn.

Farrel-Birmingham Co. Inc., Ansonia, Conn., on May 23rd held its second annual Service Banquet at Ansonia. Guests of honor were 130 men who have been with the company for a quarter-century or more. Nine of these who have served for 50 years or over, were seated at the head table. To 12 men who this year joined the ranks of the 148 with over 25 years' service, handsome service pins were presented. *John D. Martin*, who has just completed 50 years' service, received a gold watch and chain. *Nelson W. Pickering*, President of the company, was toastmaster, and *Franklin Farrel, Jr.* Chairman of the Board, presented the awards to the veteran employees. Entertainment was provided during the evening. The chief speaker of the evening was *Louis M. Ruthenberg*, President of Servel, Inc., who paid eloquent tribute to the loyalty of Farrel-Birmingham's veteran employees and urged them to view industrial relations through the eyes of "logical liberalism".

FINISH SMALL PARTS *at a profit*

Have you all the facts about ball burnishing? Facts uncovered in a demonstration on your own small metal parts? Such an experiment is frequently the first step toward making production pay extra profits. If you're unfamiliar with burnishing, developing a new product, or not getting satisfactory results from present equipment, send us a few unfinished samples. After the experiment we'll show you why high and narrow Abbott barrels assure fast production, uniform lustre, negligible unit finishing cost. Worth investigating, isn't it? The Abbott Ball Company, 1046 New Britain Avenue, Hartford Connecticut.

Stampings, spinnings, castings, forgings, screw machine products, etc.



ABBOTT
BALL BURNISHING

SPEKYELLO
(patent pending)
YELLOW BRONZE

Gives continuous, uniform color. Eliminates tinted lacquer problems. Fast, simple, easy, economical plating. Time tested. Low in cost. No license fees, no royalties.

Made by the makers of SPEKWITE.

SPECIAL SPEC CHEMICALS CORP.
30 Irving Place New York, N. Y.
Your Product Must Not Only Be Good—
It Must Look Good!

WALKER'S
Metal Lacquers and Synthetics

Prominent manufacturers put their finishing difficulties up to the Walker Company.

To produce the desired finish for a manufactured product, demands long technical experience and intense and patient research.

In many problems submitted to us we have invariably found the solution and worked it out to a practical and satisfactory result.

We invite inquiries on finishing problems from the plating shops.

H. V. WALKER CO. Elizabeth, N. J.

"FINISHES TO FIT THE PRODUCT"

New England Warehouse: Brown & Dean Co., Providence, R. I.

STEEL CHROME

STAINLESS

TRIED, TESTED AND PROVED.....

Right! SPEEDIE Buffing & Polishing Compositions have stood the test time and again. We feel confident they will continue to do so for some time to come.

The Reason? Continuous laboratory check and constant supervision assuring you of quality, uniformity and reliability.

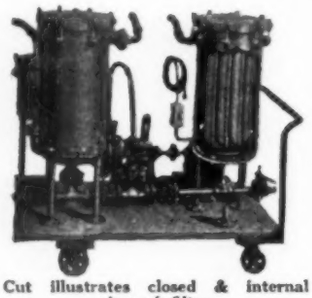
Write Today For Samples, And Informative Booklet Describing
SPEEDIE BUFFING & POLISHING COMPOSITIONS

THE BUCKEYE PRODUCTS CO.
Cincinnati, Ohio

FINISH

TRIPOLI LIME

PRESSURE FILTERS—for . . . . PLATING SOLUTIONS CLEANERS, NEUTRALIZING SOLUTION, DEGREASING SOLVENTS, ETC.



Cut illustrates closed & internal view of filter.

INDUSTRIAL FILTERS OFFER—
PERFECT CLARITY AT RATED CAPACITIES—*Guaranteed*

CLOSED FILTRATION—Filter plates locked in leak proof chamber, which means "no leaking"—"no lost solution."

LARGE FILTER CHAMBER—Affords greater sludge holding capacity making ideal system for removal of carbon or lime from treated solutions in process of eliminating iron, organic matter, oil, etc.

Write for literature including specifications on filters for HOT & BRITE NICKEL, BRITE ZINC, CHROMIUM & ELECTROCOLOR.

INDUSTRIAL FILTER & PUMP MFG. CO.
3017 W. Carroll Ave. Chicago, Ill.

NEW

RAPID & ACCURATE TEST SETS FOR BRASS & COPPER SOLUTIONS

Write for leaflets

Testing Sets for Most Plating Solutions

Colorimetric, Quinhydrone & Glass Electrode Systems for pH

KOCOUR CO.
4720 S. CHRISTIANA AVE.
CHICAGO

Hobart Manufacturing Co., Troy, Ohio, recently gave an Inauguration Dinner for Hobart's Quarter-Century Club at which 79 employees who had served the company for 25 years or more, were present. *John M. Spencer*, president made a speech of encouragement and hope. A plan was announced. Every employee who has been with the company continuously for 25 years or more, was awarded an extra week's vacation with pay for each year during which they remain in the employ of the company. Commission salesmen will receive substantial contributions to their vacation expenses. In addition, a check for $2500 was placed in the hands of the employees as a gift, to start a revolving loan fund—and to be wholly administered by the employees for their own benefit.

Tube Turns, Inc., East Broadway, Louisville, Ky., manufacturer of seamless drawn fittings, has filed plans for a one-story machine shop on S. 28th Street. Cost over $45,000 with equipment. Departments: drawing, extruding, welding. Principal base metal used: steel.

Walter Ruska & Co. Inc., Houston, Texas, manufacturers of scientific instruments, parts, etc., have let general contract for a new one-story plant, 40 x 85 ft. Cost about $45,000 with equipment. The new address is 2332 Bellaire Boulevard. Departments: soldering, cleaning, lacquering, finishing, machining, calibrating. Principal base metals used: brass, stainless steel, bronze, nickel silver and aluminum.

Willson Products, Inc., Reading, Pa., manufacturers of goggles, helmets and respiratory protective devices for dust hazards, have just completed a half million dollar plant building program in order to take care of expanding business. The enlarged five-floor factory contains in excess of 110,000 square feet of floor space.

Connecticut Blower Co., Hartford, Conn., through *Charles H. Keeney*, general manager, announces the appointment of two additional sales engineers: *Julius Lamparzyk* of Cleveland, Ohio, for exclusive sales in the State of Ohio, and *Arthur Polston* of Louisville, Ky., for exclusive sales in the State of Kentucky.

J. J. Whitehead, president of the *Whitehead Metal Products Company*, announced the opening in the Chrysler Building, New York, of a new sales office to handle the promotion of monel kitchen and laundry equipment designed for household use. A subsidiary of the *International Nickel Company, Inc.*, the Whitehead organization maintains a New York warehouse and assembly plant at 303 West Tenth Street. The new sales office provides considerable space for displays which include types and arrangements of monel sinks, enameled steel cabinets, combination sink, dishwasher and range units and monel tanks in hot water heaters.

McCray Refrigerator Co., Kendallville, Ind., has expanded facilities to modernize a complete porcelain enameling plant in-

stalled by Chicago Vitreous Enamel Product Co., Cicero, Ill.

Hardy Metallurgical Co., 315 Lexington Ave., New York, announces the election of *Raymond Lynn Patterson*, as vice-president in charge of development.

Dirigold Changes Name

As a climax to the 12 stormy years that the American Dirigold Corporation has encountered since its location in Kokomo, Indiana, there came an order last week from the Federal Trade Commission forbidding further use of the word "Dirigold" in the corporation's title and as a trade name for its products. Although the word "Dirigold" will pass out of the trade-name list, the art metal it designated will continue to be manufactured.

The corporation's president, young and capable *John P. Fredrick*, has announced the change of the company's name to *American Art Alloys, Inc.*, and the discontinuance of the word "*Dirigold*" as a tradename for its products. The company will continue operation under the same management that has controlled it since Aug. 13, 1935. No new trade name to replace the one discarded at the request of the government was indicated at this early date.

The trade commission took the position that use of the word "gold" in coining the trade name "Dirigold" implied that there would be a gold content in the company's products. The commission held that since there was no gold content, this was contrary to rules forbidding use of trade names which might be misinterpreted.

President Fredrick in answering the commission's order said, "We do not feel that their decision was justifiable, but because of the expense involved in appealing such a decision, we have decided to abide by the order."

American Dirigold was brought to Kokomo from Chicago, Illinois, under the direction of Carl A. VonMalmborg, of Sweden, one of the inventors of Dirigold and its eight allied "alco-bronze" alloys. The plant was put in operation about May 1, 1936.

After declaring bankruptcy on Oct. 4, 1930, the corporation was run under a receivership, headed by John S. Fredrick, also chairman of the Continental Steel Corporation, until it was sold under the auctioneer's hammer in June, 1935. The sale was confirmed by the courts on July 3, 1935, and a trusteeship was formed, which was in force until Aug. 13, 1935, when the present management took over the concern's affairs.

Throughout all this turbulence, the plant maintained partial production. It now is headed by John P. Fredrick, son of the former receiver of the corporation, as president-treasurer, Glen R. Hillis, vice-president, and Robert R. Arnett, secretary, and is listed as a $150,000 corporation on the records of the Secretary of State of Indiana.

Dirigold is one of a group of nine metals manufactured by the company. It looks like gold and wears like steel. Numerous articles, classed as luxuries and including table wear, thimbles, fruit dishes, candle

TRADE MARK
MATCHLESS
REG. U.S. PAT. OFF.

THE ROAD TO PROFIT
is thru
ECONOMY AND EFFICIENCY
Follow this by using
MATCHLESS
HIGH GRADE BUFFING COMPOSITIONS
BUFFS AND POLISHING WHEELS
There are no substitutes for "Matchless"

The Matchless Metal Polish Co.

840 W. 49th Pl., Chicago, Ill. 726 Bloomfield Ave., Glen Ridge, N. J.

CLINCO

WE ARE PLEASED TO ANNOUNCE A FULL LINE OF
BAKINGLACS
in Clear, Pigmented and Metallics

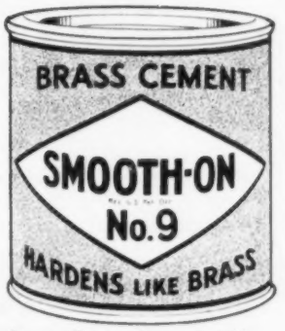
Bakinglacs have the characteristics and appearance of lacquer and the quality of synthetics; they adhere to all metals including die casting, chrome and aluminum.

Baking temperatures 225 to 275° F for one hour.

Samples furnished on request.

THE CLINTON COMPANY
1210-30 Elston Ave., Chicago, Ill.
Manufacturers of
LACQUERS, ENAMELS AND SYNTHETICS
R. J. Hazucha, Representative

Filling cement for BRASS and BRONZE
SMOOTH-ON NO. 9



THIS cement is easily applied, adheres and hardens well, matches the color and surface texture of the surrounding metal, and can be filed, machined or polished to a fine finish.

As a filling for holes, rough surface or porous spots on castings, and for seams, cracks and open spaces between assembled parts, this composition gives the same satisfaction on brass and bronze as do the three grades of Smooth-On No. 4 Iron Cement on iron and steel surfaces.

The first application will prove its desirability for the purposes intended, and the saving of a few otherwise rejected pieces pays for all the cement required in a year. Make the trial and be convinced. The cost is almost nothing. Get free samples and see for yourself.

Buy Smooth-On No. 9 in ¼-lb. or 2-lb. can.

SMOOTH-ON MFG. CO., Dept. 18, 568-574 Communipaw Ave., Jersey City, N. J.

Do it with **SMOOTH-ON**

4A CEMENT AND THINNER

Instead of Glue use
4A Cement & Thinner, a
uniform substitute for polishing
Wheels, Belts, Buffs, Rolls, Etc. Samples
of Compound or Cement Sent on Request.

The 4A brands are highly efficient for cutting down, polishing, and mirror finishing all kinds of steel including radium and stainless. The compound is used on all kinds of wheels, soft, medium and hard wheels.

HARRISON & COMPANY, HAVERHILL, MASS.

Polishing Compounds | Cement & Thinner

LACQUERS—ENAMELS—THINNERS
VARNISH and SYNTHETICS

For all Industrial Finishing Needs

For details and Color Charts
address

THE EGYPTIAN LACQUER MFG. CO.
ROCKEFELLER CENTER, NEW YORK

CLEANING COMPOUNDS

CLEPO

CLEANING COMPOUNDS

This name in your plating room assures you of a perfect adhesion in your plating cycle.

CLEPO—the ultimate in cleaning efficiency.

CLEPO heads the specification list of many of the nation's largest manufacturers.

Our Laboratory's spectacular new developments are adding new customers daily to our long list of satisfied users.

Drop a line if you have any plating problem and we will have one of our experts call upon you.

FREDERICK GUMM CHEMICAL CO., Inc.
538 Forest St., Kearny, N. J.

sticks and vases, are manufactured from it. A new product receiving wide use is the loving cup for award for winners of competitive enterprises.

The "alco-bronzes", eight in number, also manufactured by the company, are for the technical trade. They are solid metals, which never lose their luster, and their selling points are "last forever" and "easily cleaned."

Metal Market Review

June 17, 1938.

Copper suffered an unhappy spell. Although the price of domestic metal remained at 9c per lb., electrolytic, delivered Connecticut Valley. It was far from steady as foreign metal, and consequently export metal, was very unsteady, shifting back and forth between 8.80 and 8.40. At this time it is at about 8.65.

Sales were small: 3,354 tons, 4,514 tons, 4,524 and 4,681 making a total of 17,073 tons compared with 19,235 tons for the previous four weeks. Sales in May amounted to only 18,853 tons against 22,790 in April. Statistics for May showed an increase in stocks of refined copper in the United States of 14,146 tons and a reduction in foreign supplies of 1,369 tons. The increase was due almost entirely to lower consumption as curtailment programs are going into effect. Present situation very unsteady.

LATE FLASH: During the week beginning June 20th, the foreign market suddenly reversed itself and export copper climbed to 9.175, with consequent stiffening of the American market and improvement in sales.

Zinc was also unchanged, but also slow in sales and far from firm, the price remaining at 4c per pound, Prime Western, E. St. Louis. Production, however, is expected to show a decline because of the low price. Unfilled orders increased very slightly from 25,459 tons to 25,610 tons. Zinc stocks increased 12,882 tons during May. Prospects, uncertain.

LATE FLASH: The zinc market also changed sharply beginning June 21, and the metal is now selling at 4.40.

Tin improved considerably due to the agreement to the Buffer pool and also to the decision of the International Tin Committee to reduce the operating rate of the third quarter to 45%. As a result the price moved up steadily from a low of 35.85 to a present figure of something over 39. Sales were not large, however, with the American tinplate industry, the largest consumers, in their present depressed condition. Prospects—a tug-of-war between restricted production and restricted consumption.

LATE FLASH: Tin also rose suddenly at the same time as copper and zinc, now selling at 42.60.

Lead sold for a short time at 4c per lb. E. St. Louis but was reduced to 3.85 early in June. This price still obtains. Volume was good: 1,893 tons, 3,429, 8,367 and 7,772 making a total of 21,461 tons compared with 9,216 tons in the previous four-week period.

At the time of writing May statistics have not yet appeared but the tone is rather firm.

LATE FLASH: Lead joined in the sudden reversal of the market, and is now selling at 4.20.

Silver was quiet and the price unchanged at 42¾c per ounce Troy.

Scrap Metals slipped rather steadily, in fact their course was such as to presage another cut in refined copper (which has not materialized). Scrap lead and zinc also receded. Brass and aluminum ingots were consistently in the doldrums with deliveries as well as bookings poor.

LATE FLASH: Scrap metals improved suddenly, following the new metals, and the call for brass ingot improved. Aluminum is still dull.

On June 1st unfilled orders on the books of the members of the Non-Ferrous Ingot Metal Institute amounted to 8,745 tons against 9,703 tons on May 1st.

The combined deliveries of brass ingots and billets for the members in the month of May amounted to 2,782 tons compared with 2,734 tons in April.

The Institute reports prices per pound received by its members for commercial grades of ingot brass and bronze during the 28-day period ending May 13th and June 10th as follows:

	4 wks. end. April 15	4 wks. end. May 13	4 wks. end. June 10
80-10-10	11.994	11.854	11.076
78% Metal	9.320	9.259	8.360
81% Metal	9.668	9.525	9.062
83% Metal	9.840	9.857	8.868
85% Metal	10.067	10.083	9.282
No. 1 Yellow	8.291	8.323	7.871

Average Prices for Metals

	May
COPPER c/lb. Duty 4c/lb.	
LAKE (del. Conn. Producers' Prices)	9.662
ELECTROLYTIC (del. Conn. Producers' Prices)	9.600
CASTING (f.o.b. ref.)	9.144
ZINC (f.o.b. E. St. Louis) c/lb. Duty 1¾ c/lb.	
Prime Western (for Brass Special add 0.10)	4.043
TIN (f.o.b. N. Y.) c/lb. Duty Free, Straits	36.837
LEAD (f.o.b. St. L.) c/lb. Duty 2⅛ c/lb.	4.25
ALUMINUM c/lb. Duty 4 c/lb.	20.000
NICKEL c/lb. Duty 3 c/lb. Electrolytic 99.9%	35.000
ANTIMONY (Ch.) c/lb. Duty 2 c/lb.	14.461
SILVER c/oz. Troy, Duty Free	42.75
PLATINUM $/oz. Troy, Duty Free	31.976
GOLD—Official U. S. Treasury Price	35.000

TINT-METAL BRIGHT METALS IN COLOR

A "MUST SEE" FOR PRODUCTION MEN

HERE, for the first time, are really *satisfactory* and *workable* colored metals. An entirely *new principle* is used to give them brightness and warmth, the like of which you have never seen. Responsible manufacturers are invited to write for *free samples* and complete information.

BEAUTIFULLY ILLUSTRATED IN FULL COLOR in our new booklet, "*Pre-finished American Bonded Metals.*" Also shows the many ways Tint-Metal and other American *Bonded* Metals add beauty, cut costs. Contains valuable engineering data and design ideas. Write for free copy—without obligation.

AMERICAN NICKELOID COMPANY
8 SECOND STREET, PERU, ILLINOIS
Sales Offices in All Principal Cities

AN OLD STORY BUT:—
One which bears repeating:

1617
Reg. U. S. Pat. Off.

TRY 1617 THIS SUMMER.

During the hot humid days of summer when Spotting Out again becomes a problem

CLEAR METAL LACQUER

proves its superior value. It is the Original Non-Spotting Lacquer — formulated in 1927.

It is crystal clear.
Hard and durable.
Has excellent adhesion.
Does not turn green upon exposure.

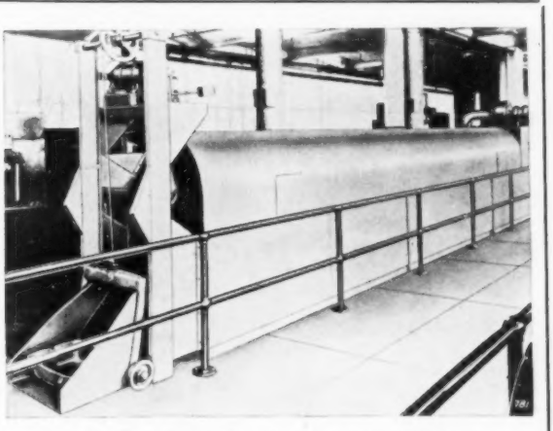
STANLEY

THE STANLEY CHEMICAL COMPANY
EAST BERLIN, CONN.
Lacquers • *Synthetics* • *Enamels* • *Japans*
A Subsidiary of THE STANLEY WORKS, New Britain, Connecticut

IDEAL
TRADE MARK REG. U.S. PAT. OFF.

washes 27 tons of screw machine products in 6 hrs.

—and, by using commercial cleaning compound instead of organic solvents, saves $1,300 a year on that alone!



IDEAL Drum Type Continuous Washing, Rinsing and Drying Machine in an Illinois plant handles work in 150 lb. batches on 30 to 90 sec. headway, cleaning oil and chips from slotted blanks. Write for full details.

Put it up to Specialists

N. Ransohoff Inc.
West 71st St. at Millcreek, Carthage, Cincinnati, O.

We also make sawdust tumbling, plating, pickling, burnishing and separating machinery.

Supply Prices, June 24, 1938

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER: Cast ..... 18⅝c. per lb.
Electrolytic, full size, 13⅝c. cut to size .. 13⅝c. per lb.
Rolled oval, straight, 14⅛c.; curved .... 15⅛c. per lb.
BRASS: Cast ..... 17⅜c. per lb.
ZINC: Cast ..... 9⅜c. per lb.

NICKEL: 90-92%, 16" and over ..... .45 per lb.
95-97%, 16" " " ..... .46 per lb.
99%+cast, 16" and over, 47c.; rolled, depolarized, 16" and over, 48.
SILVER: Rolled silver anodes .999 fine were quoted June 24, from 46c. per Troy ounce upward, depending on quantity.

White Spanish Felt Polishing Wheels

Diameter	Thickness Under ½"	½-15/16"	1-2"	2-3½"	Over 3½"
Under 1"	6.35-6.40	6.20-6.25	6.10-6.15	6.10-6.15	6.35-6.40
1" to 1 7/16"	5.85	5.70	5.60	5.60	5.85
1½" to 3 15/16"	5.55	5.35-5.40	5.30-5.35	5.30-5.35	5.60
4-5 15/16"	4.95-5.00	4.70-4.85	4.65-4.75	4.65-4.75	4.95-5.00
6", 8" & 9"	3.80-4.25	3.45-3.95	2.45-3.05	2.45-3.00	2.90-3.35
10" to 18"	3.80-4.25	3.45-3.95	2.45-2.95	2.45-2.85	2.90-3.25
Over 18"	3.80-4.25	3.45-3.95	2.70-3.05	2.70-3.00	2.90-3.35

Prices above are for less than 50 lb. For over 50 lbs. various discounts or deductions are allowed.

On grey Mexican wheels deduct 10c per lb. from above prices.

Cotton Buffs

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	$75.24
14" 20 ply 84/92 Unbleached	57.67
12" 20 ply 84/92 Unbleached	43.28
16" 20 ply 80/92 Unbleached	63.28
14" 20 ply 80/92 Unbleached	48.57
12" 20 ply 80/92 Unbleached	36.52
16" 20 ply 64/68 Unbleached	59.69
14" 20 ply 64/68 Unbleached	45.84
12" 20 ply 64/68 Unbleached	34.49

⅜" Sewed Buffs, per lb., bleached or unbleached 54c to 90c

Chemicals

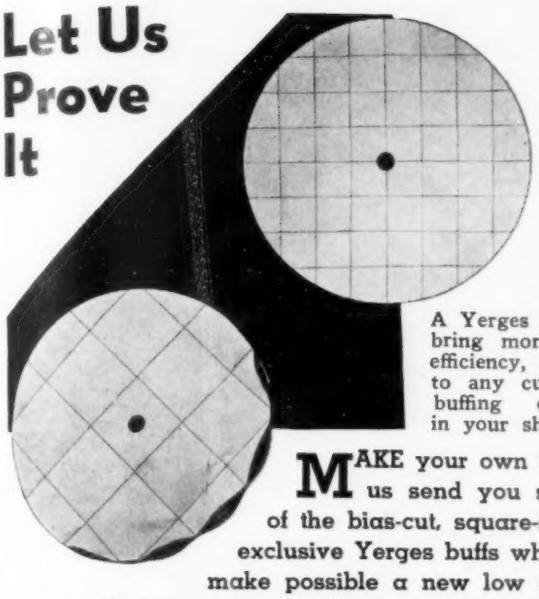
These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P. l.c.l. Drums	lb.	.06¼
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.0531-.059
Chromic, 100 lb. and 400 lb. drums		.16¾-.17¼
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.027
Hydrochloric, C. P., 20 deg., carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07½
Sulphuric, 66 deg., carboys	lb.	.02½
Alcohol—Butyl, drums (f.o.b. destination)	lb.	.10-.10½
Denatured, carloads, indust., (f.o.b. prod. pts.)	gal.	.33-.38
Alum—Lump, barrels	lb.	.0340-.0365
Powdered, barrels	lb.	.0355-.0380
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05¼
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0261-.032
Cadmium oxide, 50 to 1,000 lbs.	lb.	1.20
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05¾-.06
Chrome, Green, commercial, bbls.	lb.	.22
Chromic Sulphate, drums	lb.	.26¼
*Copper—Acetate (Verdigris)	lb.	.25
Carbonate, 53/55% cu., bbls.	lb.	.15½
Cyanide (100 lb. kgs.)	lb.	.34
Sulphate, tech., crystals, bbls.	lb.	.0470
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
*Gold Cyanide, Potassium 41%		$15.45
*Gold Cyanide, Sodium 46%		$17.10
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead—Acetate (Sugar of Lead), bbls.	lb.	.10-.12¾
Oxide (Litharge), bbls.	lb.	.12½
Lime Compositions for Nickel	lb.	.09½-.11
Lime Compositions for Brass	lb.	.09½-.11
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) Pure, drums l.c.l.	gal.	.40½
Nickel—Carbonate, dry bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08⅝
Potassium—Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 98-100%	lb.	.06¾
Cyanide, 165 lbs. cases, 94-96%	lb.	.52½
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.38¾
Cyanide, 100 oz. lots	oz.	.42¾
Nitrate, 100 ounce lots	oz.	.33¼
Soda Ash, 58%, bbls.	lb.	.0235
Sodium—Cyanide, 96 to 98%, 100 lb. drums	lb.	.15
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	3.15
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.03
Silicate (Water Glass), bbls.	lb.	.01½
*Stannate, drums	lb.	.29-.31½
Sulphocyanide, drums	lb.	.30-.35
Sulphur (Brimstone), bbls.	lb.	.02¾
*Tin Chloride, 100 lb. kegs	lb.	.34½
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
White Silica Compositions for Brass	lb.	.07½-.10
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.14-.15
Cyanide (100 lb. kegs)	lb.	.53
Chloride, drums, bbls.	lb.	.065
Sulphate, bbls.	lb.	.04

*Subject to fluctuations in metal prices.

Metal Prices on page 368.

Let Us Prove It



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Cadmium	Zinc

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Nickel Salts	Copper Sulphate
Nickel Chloride	Copper Cyanide
Nickel Carbonate	Copper Carbonate
Chromic Acid	Cadmium Oxide

Manufactured by

THE McGEAN CHEMICAL COMPANY
CLEVELAND, OHIO

McGEAN CHEMICALS

Metal Prices, June 24, 1938

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

New Metals

COPPER: Lake, 9.125, Electrolytic, 9.00, Casting, 8.525.
ZINC: Prime Western, 4.50. Brass Special, 4.60.
TIN: Straits, 42.90. LEAD: 4.35.
ALUMINUM: 20. ANTIMONY, Ch. 14.00.
NICKEL: Shot, 36. Elec., 35.
QUICKSILVER: Flasks, 75 lbs., $82. BISMUTH, $1.05.
CADMIUM, .85-$1.20. SILVER, Troy oz., official pr. N. Y., June 24, 42¾c.
GOLD: Oz. Troy, Official U. S. Treasury price $35.00.
SCRAP GOLD, 6¾c. per pennyweight per karat, dealers' quotation.
PLATINUM, oz. Troy $32-33.

Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free; lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Ingot Metals and Alloys

	Cents lb.	U. S. Import Duty	U. S. Import Tax*
No. 1 Yellow Brass	7.75	None	4c. lb.[1]
85-5-5-5	9.25	None	4c. lb.[1]
88-10-2	12.50	None	4c. lb.[1]
80-10-10	11	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	9.75	None	4c. lb.[1]
Aluminum Bronze	14.00	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	11.75	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	14.00	20% a. v.	4c. lb.[1]
No. 12 Aluminum	15.50-19	4c. lb.	None
Manganese Copper, Grade A (30%)	22-27	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	14.00	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	15.00	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	20.50	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	50-60	None	None
Iridium Platinum, 5% (Nominal)	$35	None	None
Iridium Platinum, 10% (Nominal)	$37	None	None

*** Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.**
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

Old Metals

Dealers' buying prices, wholesale quantities:	Cents. lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	5¾ to 6	Free	4c. per pound on copper content
Light copper	5⅜ to 5½	Free	
Heavy yellow brass	3⅞ to 4⅛	Free	
Light brass	3⅜ to 3⅝	Free	
No. 1 composition	5⅛ to 5⅜	Free	
Composition turnings	5 to 5⅛	Free	
Heavy soft lead	3¾ to 3⅞	2⅛c. lb.	None
Old zinc	2¼ to 2½	1½c. lb.	
New zinc clips	3¼ to 3⅜	1½c. lb.	
Aluminum clips (new, soft)	11½ to 12	4c. lb.	
Scrap aluminum, cast	5¼ to 5½	4c. lb.	
Aluminum borings—turnings	4	4c. lb.	
No. 1 pewter	23 to 25	Free	
Electrotype	4⅛ to 4¼	2⅛c. lb.*	
Nickel anodes	29 to 30	10%	
Nickel clips, new	30 to 31	10%	
Monel scrap	7½ to 13½	10% av.	

*** On lead content.**

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' lists, effective since May 20, 1938. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

Copper Material

	Net base per lb.	Duty*
Sheet, hot rolled	17⅛c.	2½c. lb.
Bare wire, soft, less than carloads	13⅛c.	25% a. v.
Seamless tubing	17⅝c.	7c. lb.

*** Each of the above subject to import tax of 4c. lb. in addition to duty under Revenue Act of 1932.**

Nickel Silver

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	25⅝c.	10% Quality	28¼c.
15% Quality	27¾c.	15% Quality	32⅝c.
18% Quality	29 c.	18% Quality	35⅞c.

Brass and Bronze Material

	Yellow Brass	Red Brass	80% Comm'l. Bronze	Duty	U. S. Import Tax
Sheet	15⅝c.	16⅜c.	17¼	4c. lb.	4c. lb. on copper content.
Wire	15⅞c.	16⅝c.	17⅜	20%	
Rod	11⅝c.	16⅝c.	17⅜	4c. lb.	
Angles, channels	24⅛c.	24⅞c.	25¾	12c. lb.	
Seamless tubing	18⅜c.	18⅞c.	19⅝	8c. lb.	
Open seam tubing	24⅛c.	24⅞c.	25¾	20% a. v.	

Tobin Bronze and Muntz Metal

Net base prices per pound.	(Duty 4c. lb.; import tax 4c. lb. on copper content.)
Tobin Bronze Rod	17½c.
Muntz or Yellow Rectangular and other sheathing	18⅞c.
Muntz or Yellow Metal Rod	15 c.

Aluminum Sheet and Coil

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, carload lots, per lb.	33.00c.
Aluminum coils, 24 ga., base price, carload lots, per lb.	28.50c

Rolled Nickel Sheet and Rod

Net Base Prices

Cold Drawn Rods	50c.	Standard Cold Rolled Sheet	49c.
Hot Rolled Rods	45c.		

Monel Metal Sheet and Rod

Hot Rolled Rods (base)	35c.	No. 35 Sheets (base)	37c.
Cold Drawn Rods (base)	40c.	Std. Cold Rolled Sheets (base)	39c.

Silver Sheet

Rolled sterling silver (May 27) 45c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

Zinc and Lead Sheet

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots standard sizes and gauges, at mill, less 7 per cent discount	9.75	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	10.75	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	14.75	2c. lb.
Full Lead Sheet (base price)	7.50	2⅜c. lb.
Cut Lead Sheet (base price)	7.75	2⅜c. lb.

Block Tin, Pewter and Britannia Sheet

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 366.

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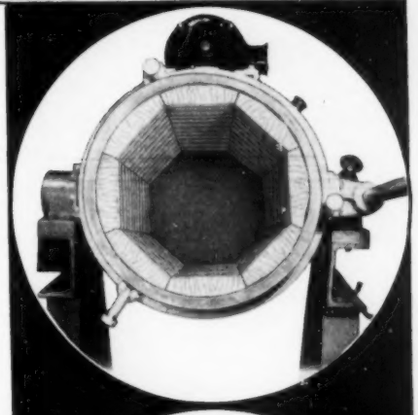

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1868-1935

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